THE SIMPLE ASCIDIANS FROM THE NORTHEASTERN PACIFIC IN THE COLLECTION OF THE UNITED STATES NATIONAL MUSEUM.

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INTRODUCTION.

Although the collection of Ascidians which is the subject of this memoir is not of exceptional magnitude or interest, and although much time and labor have been expended on it, yet I am aware that much more study could have been profitably devoted to it. Particularly might the descriptions have been carried further in the direction of the number of individuals examined for each species. It is not at all impossible that had this been done the specific groups recognized would have been different in several instances. Furthermore, I am convinced that the methods currently employed in systematic ascidiology, particularly for counting structures the characteristics of which are given quantitatively, ought to be more refined and accurate than they are. Were our observational procedure to be improved in the two respects mentioned, and were statistical methods to be made more use of, I have no doubt that highly rewarding results over and above those now reached by systematic studies would come forth; not only would the central aim of classificatory research, namely, the delimitation and definition of groups, be made more trustworthy, but various interests beyond those of classification proper would be at least formulated.

The value of systematic studies as a revealer of problems comes from the circumstance that, bringing, as of necessity they do, before the student large numbers of individuals and kinds of individuals every one of which is different in some way from any of the others, they inevitably raise questions almost as numerous and varied as the organisms themselves.

Looking upon systematic zoology in this way and so taking it for granted that the collection now in hand will be worked over again in the future by other zoologists employing more rigorous methods, I have prepared, as far as possible in tabular form, considerable matter not usually included in papers on systematic ascidiology.

While much regretting that a larger number of dissections could not be made and the data ascertained with greater accuracy, one consideration goes a long way in the direction of alleviation of this regret. No amount of accurate work on the specimens that come into one's hands can make up for deficiencies in the collections themselves. Deficiencies in collections are usually of three sorts, mainly: Insufficiency of number of individuals; insufficiency of representation of the various parts of the geographic range, horizontal and vertical, of the groups; and poorness of preservation of the specimens. Inadequacy of locality and other incidental data is also not infrequent, but on the whole this is less serious according to my experience than the other items mentioned, especially as concerns collections made in later years. The collection is very rich in number of individuals of some of the species; but in no case is the distribution of these individuals with respect to the geographic range of the species what one would like to have it. Again, several of the species, even some of those treated as new to science, are represented by only one or a very few individuals. This is unfortunate. On the whole, the state of preservation of the specimens is better than might have been expected considering the conditions under which the collecting was done. Special reference ought to be made, I feel, to the extent to which the value of the collection is due to the work as a collector done by Dr. W. H. Dall in the early seventies of the last century, when Alaska was hardly more than a map to most persons in the United States. The services of Doctor Dall in this connection are notable in view of the adverse conditions under which his natural history work was carried on.

The part played by the United States Fisheries Bureau steamer *Albatross* in gathering material is dealt with in a special section.

I am glad to acknowledge the helpfulness of the officials of the United States National Museum, particularly in granting small sums of money to aid in the work and also for the efficiency and patience of Dr. Myrtle E. Johnson in making dissections, rough sketches, and finished illustrations.

Although a considerable number of papers, old and new, now exist dealing with the ascidians of the north Pacific, the recent extensive summarization not only of these but of the literature of the whole group given by Hartmeyer in his Tunicata of Bronn's Tierreich, makes a general review of the work to which reference is made in this report unnecessary. No student would presume to work seriously on ascidians from any part of the world now or for many years to come without Hartmeyer's writings constantly at hand; and with these it would hardly be possible for him to miss altogether any of the literature with which he should be concerned. It is a great pleasure to me to speak of the comprehensiveness and accuracy with which Hartmeyer has done his work, and I genuinely regret that in a few important matters I am unable to follow him, at least for the present. To the very recent paper by Huntsman, 1911, dealing with the ascidians of the Canadian coasts, Pacific as well as Atlantic, ample reference is made in other connections.

SPECIES IN THE COLLECTION ARRANGED BY FAMILIES.

MOLGULIDÆ.

1. *Molgula oregonia*, new species.
2. *Molgula retortiformis.*
3. *Molgula crystallina.*
4. *Molgula siphonalis.*
5. *Eugyrioides dalli*, new species.
6. *Eugyrioides rara.*
7. *Rhizomolgula ritteri.*

HALOCYNTHIIDÆ.

8. *Halocynthia washingtonia*, new species.
9. *Halocynthia haustor.*
10. *Halocynthia haustor foliacea*, new subspecies.
11. *Halocynthia aurantium.*
12. *Halocynthia echinata.*
13. *Halocynthia villosa.*
14. *Halocynthia castaneiformis.*
15. *Halocynthia okai.*
16. *Halocynthia johnsoni.*
17. *Boltenia ovifera.*

   Hartmeyeria, new genus.

18. *Hartmeyeria triangularis*, new species.
19. *Culeolus sluiteri*, new species.

STYELIDÆ.

20. *Styela macrenteron*, new species.
21. *Styela hemicæspitosa*, new species.

STYELIDÆ—Continued.

22. *Styela sabulifera*, new species.
23. *Styela loveni.*
24. *Styela gibbsii.*
25. *Styela yakutatensis.*

   Styela, species.

26. *Styelopsis grossularia.*
27. *Dendrodoa tuberculata.*
28. *Dendrodoa subpedunculata.*
29. *Dendrodoa adolphi.*
30. *Pelonaia corrugata.*

RHODOSOMIDÆ.

31. *Chelyosoma columbianum.*
32. *Chelyosoma productum.*
33. *Corella willmeriana.*
34. *Corella japonica.*

   Corella, species.

35. *Corellopsis pedunculata.*
36. *Corynascidia herdmani*, new species.
37. *Agnesia beringia*, new species.

PHALLUSIIDÆ.

38. *Phallusia vermiformis*, new species.
39. *Phallusia unalaskensis*, new species.
40. *Phallusia adhærens.*

CIONIDÆ.

41. *Ciona intestinalis.*

DISTRIBUTION.

It would be possible to treat the data under this head in considerably more detail, but I have done as much as seems profitable for the amount and character of the collection.

The collections so far made in the northeastern Pacific are sufficient to give a general picture only of the ascidian life of the regions, and a manipulation of the data in great detail would produce results in large measure not only unreliable, but deceptive, for they would have the appearance of a significance which in reality they would not possess.

HORIZONTAL DISTRIBUTION.

The 41 species and subspecies recognized in the report fall into three of the five latitude zones into which Hartmeyer has divided the seas of the earth, namely, ARCTIC, SUBARCTIC, and TROPIC. Since, however, nearly all the collecting to which the report pertains was done in the first two zones, the species belonging to the Tropic are so few as to hardly figure in the results.

This distribution among the zones is shown in Table 1.

TABLE 1.

Zonal distribution of the species.

Arctic exclusively.	Subarctic exclusively.	Common to Arctic and Subarctic.
Species.	Species.	Species.
Molgula retortiformis.	*Molgula oregonia.*	*Halocynthia aurantium.*
Molgula crystallina.	*Culeolus sluiteri.*	*Halocynthia echinata.*
Molgula siphonalis.	*Halocynthia washingtonia.*	*Styela hemicæspitosa.*
Eugyrioides dalli.	*Halocynthia haustor.*	*Phallusia adhærens.*
Eugyrioides rara.	*Halocynthia haustor foliacea.*	*Ciona intestinalis.*
Rhizomolgula ritteri.	*Halocynthia villosa.*	
Boltenia ovifera.	*Halocynthia castaneiformis.*	
Hartmeyeria triangularis.	*Halocynthia okai.*	
Styela macrenteron.	*Halocynthia johnsoni.*	
Styela sabulifera.	*Styela gibbsii.*	
Styelopsis grassularia.	*Styela yakutatensis.*	
Dendrodoa tuberculata.	*Styela loveni.*	
Dendrodoa subpedunculata.	*Chelyosoma productum.*	
Dendrodoa adolphi.	*Chelyosoma columbianum.*	
Pelonaia corrugata.	*Corella willmeriana.*	
Corellopsis pedunculata.	*Corella japonica.*	
Corynascidia herdmani.	*Phallusia vermiformis.*	
Agnesia beringia.		
Phallusia unalaskensis.		
19 species, 46 per cent.	17 species, 41 per cent.	5 species, 12 per cent.

Considering the species with reference to the seas in which they occur and disregarding latitude zones, we get

TABLE 2.

Common to the Pacific and Atlantic Oceans.	Pacific only.
Molgula retortiformis.	*Molgula oregonia.*
Molgula crystallina.	*Eugyrioides dalli.*
Eugyrioides rara.	*Halocynthia aurantium.*
Rhizomolgula ritteri.	*Halocynthia washingtonia.*
Halocynthia echinata.	*Halocynthia haustor.*
Boltenia ovifera.	*Halocynthia haustor foliacea.*
Styela loveni.	*Halocynthia villosa.*
Styelopsis grossularia.	*Halocynthia castaneiformis.*
Dendrodoa adolphi.	*Halocynthia okai.*
Pelonaia corrugata.	*Halocynthia johnsoni.*
Ciona intestinalis.	*Hartmeyeria triangularis.*
	Culeolus sluiteri.
	Styela macrenteron.
	Styela hemicæspitosa.
	Styela sabulifera.
	Styela gibbsii.
	Styela yakutatensis.
	Dendrodoa tuberculata.
	Dendrodoa subpedunculata.
	Chelyosoma productum.
	Chelyosoma columbianum.
	Corella willmeriana.
	Corella japonica.
	Corynascidia herdmani.
	Angesia beringia.
	Phallusia vermiformis.
	Phallusia unalaskensis.
	Phallusia adhærens.
11 species, 28 per cent.	28 species, 72 per cent.

Considered with reference to distribution in different parts of the Pacific Ocean, we get

TABLE 3.

Bering Sea.	South of Bering Sea only.	Common to Bering Sea and southward.
Molgula crystallina.	*Molgula oregonia.*	*Molgula retortiformis.*
Molgula siphonalis.	*Halocynthia washingtonia.*	*Halocynthia aurantium.*
Eugyrioides dalli.	*Halocynthia haustor.*	*Halocynthia echinata.*
Eugyrioides rara.	*Halocynthia haustor foliacea.*	*Culeolus sluiteri.*
Rhizomolgula ritteri.	*Halocynthia castaneiformis.*	*Styela hemicæspitosa.*
Boltenia ovifera.	*Halocynthia okai.*	*Styela loveni.*
Hartmeyeria triangularis.	*Halocynthia villosa.*	*Phallusia adhærens.*
Styela macrenteron.	*Halocynthia johnsoni.*	
Styela sabulifera.	*Styela gibbsii.*	
Styelopsis grossularia.	*Styela yakutatensis.*	
Dendrodoa tuberculata.	*Chelyosoma productum.*	
Dendrodoa subpedunculata.	*Chelyosoma columbianum.*	
Dendrodoa adolphi.	*Corella willmeriana.*	
Pelonaia corrugata.	*Corella japonica.*	
Corynascidia herdmani.	*Corellopsis pedunculata.*	
Agnesia beringia.	*Phallusia vermiformis.*	
Phallusia unalaskensis.	*Ciona intestinalis.*	
17 species, 41 per cent.	17 species, 41 per cent.	7 species, 17 per cent.

Table 3 brings out the sharpness with which the Bering Sea is separated from the main Pacific Ocean as an ascidian province.

There is doubt as to what province species occurring on the south as well as on the north shores of the Aleutian Islands should be assigned. The principle I have followed is that species like *Dendrodoa tuberculata*, which are abundant in Bering Sea and are unknown southward except along the south shore of the Aleutian chain, should be counted as exclusively Bering Sea species.

On the other hand, *Culeolus sluiteri*, for example, is assigned to south of Bering Sea only, though it occurs near the Aleutian Islands, but on the south side. Only more extensive collecting can resolve these questions.

VERTICAL DISTRIBUTION.

Table 4 exhibits the depth range of the species as indicated by the data accompanying this collection.

TABLE 4.

Species.	Shore.	Shore to 25 fathoms.	25 to 50 fathoms.	50 to 100 fathoms.	100 to 200 fathoms.	200 to 300 fathoms.	300 to 500 fathoms.
1. *Molgula oregonia*			×				
2. *Molgula retortiformis*		×	×				
3. *Molgula crystallina*		×	×	×	×		
4. *Molgula siphonalis*			×				
5. *Eugyrioides dalli*		×	×				
6. *Eugyrioides rara*		×					
7. *Rhizomolgula ritteri*		×					
8. *Halocynthia washingtonia*					×		
9. *Halocynthia haustor*	×				×		
10. *Halocynthia haustor foliacea*			×				
11. *Halocynthia aurantium*		×	×	×			
12. *Halocynthia echinata*		×	×				
13. *Halocynthia villosa*		×					
14. *Halocynthia castaneiformis*			×				
15. *Halocynthia okai*			×				
16. *Halocynthia johnsoni*	×						
17. *Boltenia ovifera*		×	×	×			
18. *Hartmeyeria triangularis*		×					
19. *Culeolus sluiteri*						×	
20. *Styela macrenteron*		×	×	×			
21. *Styela hemicæespitosa*			×	×		×	
22. *Styela sabulifera*		×	×				
23. *Styela loveni*		×					×
24. *Styela gibbsii*	×		×				
25. *Styela yakutatensis*				×			
26. *Styelopsis grossularia*	×						
27. *Dendrodoa tuberculata*	×		×	×			
28. *Dendrodoa subpedunculata*	×	×					
29. *Dendrodoa adolphi*		×					
30. *Pelonaia corrugata*			×				
31. *Chelyosoma columbianum*				×	×		
32. *Chelyosoma productum*	×	×					
33. *Corella willmeriana*		×					
34. *Corella japonica*					×		
35. *Corellopsis pedunculata*				×			
36. *Corynascidia herdmani*							×
37. *Agnesia beringia*		×	×				
38. *Phallusia vermiformis*			×				
39. *Phallusia unalaskensis*						×	
40. *Phallusia adhærens*	×	×					
41. *Ciona intestinalis*	×						

Since practically all the specimens collected by dredging and accompanied with data as to depth are collections made by the Bureau of Fisheries steamer *Albatross*, an examination of this vessel's operations with reference to the ascidians obtained has been made. Townsend's "Dredging and Other Records, etc." (1901) makes such an examination practicable.

The total number of hauls contained in this list as made since the *Albatross* entered the waters of the Pacific in 1888, and which belong to areas from which ascidians covered by this report were derived, is 676.

The depths at which these hauls were made is shown in Table 5.

TABLE 5.

Depth at which 676 dredge and trawl hauls were made in the north Pacific from May, 1888, to May, 1896.

100 fathoms and less.	100 to 200 fathoms.	200 to 300 fathoms.	300 to 500 fathoms.	500 fathoms and more.
524	52	37	30	34
77.5 per cent.	7.6 per cent.	5.5 per cent.	4.4 per cent.	5.0 per cent.

At 77, or 1 per cent of these 676 stations, ascidians were obtained. The quantitative distribution of the species according to depth is shown in table 6.

TABLE 6.

	100 fathoms and less.	100 to 200 fathoms.	200 to 300 fathoms.	300 to 500 fathoms.	500 fathoms and more.
Hauls	524	52	37	30	34
Hauls taking ascidians	68	4	3	1	1
Per cent	13—	7.6—	8.1	3.3	3—

NOMENCLATURE.

It is very unfortunate that the efforts of Hartmeyer to reform the nomenclature of the Tunicata in accordance with the international rules should not have met with greater success. In view of the failure of some writers, as, for instance, Herdman, to accept any of the changes, and of the dissent by Huntsman, especially, from Hartmeyer's application of the rule of priority in one of the most important cases, I find myself in some perplexity as to what course to pursue. Undoubtedly, as matters now stand, the nomenclature of the group is in a worse state of confusion than ever, and until agreement can be reached as to the changes really required by the rules it has seemed to me that in the interest of the prime desideratum for a system of naming, namely, stability, it is best to adhere to the generic and family names that had been in use without exception for many years previous to Hartmeyer's revision. This decision does not, I would remark, enroll me among those who oppose the strict application of the rule of priority. As a matter of fact I am in favor of such application. But, according to my understanding, the question with which I am confronted at this moment is not as to whether, in general, the rule should be followed; but, admitting that it should be, whether *in the specific cases* at hand it should be applied.

The proposed changes with which I am here concerned are *Cæsira* for *Molgula; Pyura* for *Halocynthia; Tethyum* for *Styela;* and *Phallusia* for *Ascidia.*

My decision has been influenced by the fact that the names to be set aside are long and well established not only in technical treatises on ascidian classification, but as well in general zoological and biological literature. The principle in accordance with which this consideration has influenced me is that names thus well established should have the benefit of any reasonable doubt about the applicability of the rule. It seems to me that evidence for the suppression of such names as those here in question ought to be as unequivocal as that required to convict a man of murder in a criminal court. Viewed in the light of this principle I believe the first three indicted names, *Molgula*, *Halocynthia*, and *Styela*, would be retained.[1]

Concerning *Cæsira*, it appears to me that Hartmeyer has not removed the doubt that has for years surrounded Fleming's proposal to make Savigny's "Cynthie Dione" the type-species of a genus *Cæsira*. Indeed, Hartmeyer's inability to include *dione* in the list of "good species" in his Tierreich catalogue (Hartmeyer, 1909*a*), and his explicit statement (Hartmeyer, 1908, p. 18) that the type-species of *Cæsira* "bedarf allerdings einer Nachuntersuchung, da die Beschreibung in einigen Punkten zu lückenhaft ist, um eine hinreichende Kennzeichnung innerhalb der Gattung zu ermöglichen," places the animal used by Fleming as the type of *Cæsira* among the *species inquirendæ*, which are excluded by the international rules from competency to serve as generic types.

The doubts about *Pyura* are of a very different nature. While it is quite probable that the "piure" of modern Chilean fishermen sent to Michaelsen (Michaelsen, 1904, p. 15) is specifically identical with Molina's *P. chilensis*, the evidence before us is not conclusive. For instance, the tendency of fishermen to apply the same name to animals which much resemble one another, even though they may be very different zoologically considered, is well known. The ordinary fisherman would be quite unlikely to distinguish between some Halocynthias and some Styelas, for example; so before we could be certain that the animals examined by Michaelsen belong to Molina's species we should have to be sure that there is but one species called "piure" by the fishermen. More exhaustive collecting on the Chilean coast may sometime remove this uncertainty, but in the meanwhile *Halocynthia* should have the benefit of the doubt.

Tethyum is put into a peculiarly unfortunate condition by Huntsman's disagreement with Hartmeyer. Into the merits of the case I do not need to go. It affords a striking illustration of the inability of the rule of priority to save nomenclature from confusion so long as

[1] It seems as though a permanent international court or commission of nomenclatorial experts may be necessary (if the present commission is not charged with this duty) to take evidence and hear arguments both for and against as to whether changes in particularly important instances are compelled by the rules. At any rate, as matters now stand, if our experience in tunicate nomenclature is any guide, there is little prospect of improvement in the consistency and stability of zoological names.

there is lack of agreement as to its application in particular instances. From Hartmeyer's published statement (1909*b*) it appears that he and Huntsman discussed the question privately to some extent before Huntsman published on it; so we must understand that the perplexity was introduced by Huntsman with deliberation. Until an adjustment is reached on the points at issue in this case the principle of "benefit of the doubt" seems particularly appropriate. Accordingly *Styela* stands pending unanimity of view as to what name has the prior claim.

Hartmeyer's argument to the effect that *Ascidia* should give way to *Phallusia* I accept, and the more readily that *Phallusia* has well-nigh as good a place in general literature as has *Ascidia*.

I believe usage should be a factor in adjudicating conflicting claims between natural history names, as well as in certain classes of cases at law.

DESCRIPTIONS OF SPECIES.

MOLGULA OREGONIA, new species.

Superficial characteristics.—Ovate, the long axis transverse, stiff and hard in general consistency, this due partly to the rigidity of the test and partly to the incrustation of sand which forms a nearly uniform layer over the whole surface in most specimens, the sand grains being embedded in the test itself rather than adherent to the coarse filiform test processes which are restricted to a few patches or tufts. Excepting for irregularities apparently due to post-mortem changes, general outline rather regular though test somewhat wrinkled in some specimens; a few individuals having worm tubes, and other smaller ascidian species clinging to them. Siphons entirely absent so far as can be determined; orifices very small, discoverable only by the most careful scrutiny; situated on the side, nearly equally distant from the two ends, the branchial being somewhat nearer the anterior than the atrial is to the posterior; distance apart slightly greater than the distance of the atrial from the posterior end. Dimensions of one of the largest specimens, 22 by 15 by 13 mm.; of a second specimen, 18 by 13 by 10; of a third, 18 by 14 by 15. Test less than 1 mm. thick, dense, thick, and not at all transparent. Mantle rather thick, yellowish opaque over the anterior third, thin and semitransparent elsewhere except for the voluminous gonads; muscle bands of the mantle radiating from the orifice, entirely hidden in the vicinity of the openings by the thickened yellowish epithelial mantle tissue, reaching back to about the middle of the body all around; lobing of the orifices (six, branchial; four, atrial) obscure, even when test is removed.

Respiratory system.—Branchial tentacles about 15, possibly a few more minute ones, 8 or 10 of larger size, some of these large and thick and copiously branched, the branching being secondary as well as primary. Dorsal tubercle small, the hypophysis mouth a simple, narrow horseshoe in shape. Branchial sac with six folds on each side, none of the folds with less than 6 longitudinal vessels, and some with 12 or 13, never more than one vessel between the folds, more frequently none at all, the individual vessels on the folds broad and strong and usually close together; transverse vessels very few, entirely absent for long stretches in the spaces between the folds; infundibula reaching deep into the prominent folds, but not easily seen on surface views of the inside of the sac on account of the crowded condition of the longitudinal vessels of the folds; stigmata long, rather regular, and usually straight and directed lengthwise in the spaces between the folds. Dorsal lamina with plain edge throughout its course.

Alimentary system.—The narrow intestinal loop situated on the left side, but far back and extending across the entire body; the two limbs of the loop almost in contact with each other except at the closed end, this end again bent sharply forward making a short second double-tubed loop. Stomach but little greater in diameter than the gut; the wall presenting a number of low, rather inconspicuous irregular lobes. Anus situated very close to the atrial orifice, the rim nearly or quite plain. Renal organ an elongate, bean-shaped body situated far back on the right side, somewhat concave on its anterior edge and convex on its posterior edge to correspond with the rounded outline of the body, length nearly equaling one-half the longest diameter of the body removed from the test.

Reproductive system.—Voluminous on both sides of the body, that of the left lying above and close along the intestinal loop; that of the right above and close along the renal organ, reaching down somewhat on the anterior end of the latter. Ovary and testes intimately commingled, the cylindric ovary occupying the middle and entirely surrounded by the testes; the mass of the left side as long as the intestinal loop and in addition extending into and quite filling the concavity of the secondary loop.

So far as I am able to determine this species has more in common with *M. impura* Heller, 1887, than any other species. From this it differs, however, in having a harder test, in possessing a maximum of a dozen or more longitudinal vessels on the largest branchial folds, and in the limited size of the gonad of the right side. According to Michaelsen, 1908, who had made a careful study of Heller's species, the right gonad extends around the anterior half of the renal organ. While in our species the testis part especially reaches well down across the anterior end of the organ, it does not pass around on to the posterior side.

Hartmeyer, 1912, has made a commendable effort to mark off a number of subgroups within the genus *Molgula*. The leading point made use of by him in this classification is the number of longitudinal vessels in the folds of the branchial sac. The largest number in any group—the "*arenata* group"—is given as 4 to 6. On this basis *M. oregonia* would not fall into any of the recognized groups, for the number here is always and very definitely greater. The scheme of vessels in a typical specimen is:

$$\text{Endostyle}\begin{cases} 7\text{–}0\text{–}\mathit{9}\text{–}1\text{–}\mathit{10}\text{–}1\text{–}\mathit{10}\text{–}1\text{–}\mathit{11}\text{–}0\text{–}\mathit{8}\ \text{L.} \\ 7\text{–}1\text{–}\mathit{10}\text{–}1\text{–}\mathit{11}\text{–}1\text{–}\mathit{11}\text{–}1\text{–}\mathit{11}\text{–}0\text{–}\mathit{10}\ \text{R.} \end{cases}$$

While in some genera of ascidians the variability in the number of vessels is so great, and the difficulty of counting so considerable that the excess in the numbers here given over the numbers in *M. impura* might not be regarded as significant unless based on the averages of many individuals, the numbers in the species of *Molgula* with which we are now dealing are so constant and so definitely determinable, that there can be no question about the specific significance of the differences, particularly since these are correlated with other small, but seemingly constant differences.

Albatross 3088 (type-locality), lat. 44° 28′ N.; long. 124° 25′ 30″ W., off Oregon, 46 fathoms, c. p., September 3, 1889, 16 specimens.

Albatross 3213, lat. 54° 10′ N.; long. 162° 57′ 30″ W., South Alaska Peninsula, 41 fathoms, bk. s., May 21, 1890, a single specimen.

Type.—Cat. No. 5682, U.S.N.M.

MOLGULA RETORTIFORMIS Verrill.

Molgula retortiformis Verrill, 1871, p. 56, fig. 3.

Molgula grœnlandica Traustedt, 1880, p. 425.—Wagner, 1885, pp. 124–150, pl. 15, figs. 1–9; pl. 16, figs. 1–8, 13, and 15; pl. 17, figs. 1–17; pl. 18, figs. 11 and 13; pl. 20, figs. 2, 3, and 16–18.

Molgula siphonalis Hartmeyer, 1899, p. 462, fig. B; pl. 22, fig. 2; pl. 23, figs. 2 and 13.

Molgula graphica Ritter, 1901, p. 230, pl. 28, figs. 6–9.

Molgula retortiformis Hartmeyer, 1903, p. 145.

Caesira retortiformis Hartmeyer, 1909*a*, p. 1324.—Van Name, 1912, p. 510, text figs. 18 and 19; pl. 52, figs. 50–52; pl. 69, figs, 139, 140.

There being available for comparison several specimens of *Molgula retortiformis* from Marthas Vineyard identified by Prof. A. E. Verrill, I do not now hesitate to confirm Hartmeyer's conjecture that *M. graphica* Ritter is only a synonym for *M. retortiformis.* The species is obviously a rather common inhabitant of the shallow waters of the northeastern Pacific and Bering Sea.

I have examined the single specimen on which *M. graphica* was founded, giving special attention to the network of jet black blood vessels in the test on which I relied so largely for the validity of the species. The vessels themselves differ in no recognizable way either in structure, abundance, or distribution from those in the test of the Marthas Vineyard specimens or specimens from Bering Sea. The one peculiarity about the *graphica* vessel is the color. This is due to the coloration of the cells of the blood. These are exceedingly numerous and the vessels of about the outer half, in thickness, of the test, become greatly congested with these black cells. In one other specimen, a very large one from Bering Sea, the test vessels present something of the same condition, the congestion being, however, less general and the color a less pronounced black. What the meaning is of this condition of the blood cells in some individuals is far from clear. It ought to be stated that some of the internal parts of the *graphica* specimen are dark, almost black, in places. The hypophysis may be especially mentioned as an example. One might say that these specimens with so much black blood are melanic variants comparable to the black individuals which appear occasionally in several species of higher animals the normal color of which is some other than black. Or it may be surmised that the condition is one of disease; or there may be some other explanation. The color here appears to be quite a different thing from that in *Ascidia nigra.* Black pigment is so rare among tunicates that the question of its nature when it does occur is of considerable interest and would repay an investigator who would take it up.

The point of internal structure which has stood most in the way of identifying not only the single *graphica* specimen, but also several belonging to the present collection as *retortiformis*, is the dorsal lamina. In my original description of *graphica* I spoke of this as having "suggestions of a few remote processes on the edge" of the "rather broad membrane"; and in two or three of the specimens now examined our rough notes speak of "a slight serration" of the lamina or "intimations of teeth" on the edge. On reexamining most of these instances I find that "teeth" and "serration" and "processes," with the meaning that these terms usually have when used to describe the condition of the dorsal lamina of ascidians, is hardly applicable here. A more accurate statement would be that in some instances the dorsal membrane, or a portion of it, is uneven, or irregularly scalloped. This departure from a strictly "plain-edged" condition is, I think, a purely individual matter.

A few specimens from several of the lots are small (young?) for the species, and coated to a considerable extent with sand, a state of things which, though so characteristic for many species of Molgula, is strikingly absent in the larger individuals of *retortiformis*. Hartmeyer has noted the same thing in the collections of the species examined by him; so it may be safe to conclude that young animals are more apt to be sand covered than older ones.

The large size of some of the individuals deserves notice. One is 10 cm. in its greatest extension, and since all the animals approach the sphere in shape the mass of such an individual is great for an ascidian. Other specimens are only a little smaller.

Albatross stations: 3238 (1 specimen), lat. 58° 3′ 40″ N.; long. 158° 37′ 30″ W., 18 fathoms, fne. gy. s., June 7, 1890 (Bering Sea); 3292 (3 specimens), lat. 57° 14′ N.; long. 159° 35′ W., 32 fathoms, bk. s. g., July 18, 1890 (Bering Sea); 3293 (1 specimen), lat. 57° 30′ N.; long. 159° 33′ W., 30 fathoms, fne. gy. s., July 18, 1890 (Bering Sea); 3296 (2 specimens), lat. 57° 26′ 30″ N.; long. 158° 46′ W., 24 fathoms, gy. s. bk. sp., July 19, 1890 (Bering Sea); and 3303 (1 specimen), lat. 57° 27′ N.; long. 160° 23′ 30″ W., 33 fathoms, bk. s., July 21, 1890 (Bering Sea).

All these stations are in the southeastern part of Bering Sea.

Other stations: Nikolski, Bering Island (2 specimens), *Albatross* June 3, 1892; No. 2502, Commander Islands, Siberia (2 specimens), Leonhard Stejneger, collector, 1882–83.

Many of the specimens were associated with *Boltenia ovifera*.

MOLGULA CRYSTALLINA (Möller).

Clavelina crystallina Möller, 1842, p. 95.—Hartmeyer, 1903, p. 134.

Pera crystallina Verrill, 1872, p. 290, pl. 8, fig. 9.—Hartmeyer, 1899, p. 455, text fig. A; pl. 22, fig. 1; pl. 23, figs. 1, 16.

Caesira crystallina Hartmeyer, 1909*a*, p. 1323.—Van Name, 1912, p. 494, text figs. 12 and 13; pl. 48, figs. 31–33.

The Molgulids grouped together under this name have but five folds in the branchial sac, and for this reason have, with several other species possessing the same peculiarity, been made into a distinct genus, *Pera*. It is with some hesitation that I refuse to recognize this generic group. On the whole it seems to me advantageous to set off from so large a genus as *Molgula*, any smaller group when this can be done on the basis of so distinctive a character as that here mentioned. However, so long as *Molgula* as usually accepted, contains one lot of species having six folds, and another lot having seven, I conclude that on the whole, for consistency's sake, the species with five folds should also be retained.

Some of the specimens examined appear to be without the peduncle, as Hartmeyer, 1899, states is the case with some of the specimens in the collections studied by him. Hartmeyer found that whereas the species had been described as having about 12 tentacles, close study revealed to him 144, in 5 sizes, many of them being very small. My observation too, is to the effect that all but 20 or so of the largest are likely to be overlooked.

Localities.—Although the species was not taken in quantity anywhere, a few specimens are at hand from eleven stations. These are:

Albatross 3213, latitude 54° N.; longitude 162° 54′ W. (a little south of the Alaska Peninsula), 41 fathoms, bottom bk. s., May 21, 1890; two small specimens.

Albatross 3214, 54° 13′ N.; 163° 06′ W., 38 fathoms, gy. s. g., May 21, 1890; 1 small specimen.

Albatross 3262, 54° 49′ 30″ N.; 165° 02′ W., 43 fathoms, bk. s. r., June 24, 1890; 1 small specimen.

Albatross 3278 and 3282, near together in the southeastern part of the Bering Sea, the first in 47 fathoms, the second in 53, both on fne. gy. s. bottom, both in June, 1890. A single specimen from each station.

Albatross 3222, 54° 20′ N.; 165° 30′ W., 50 fathoms, bk. s. p. sh., five specimens.

Albatross 2848, 55° 10′ N.; 160° 18′ W., 110 fathoms, gn. m., July 31, 1888, one specimen.

Besides these *Albatross* specimens there is one lot of four collected in June, 1884, by Lieut. George M. Stoney, United States Navy, in 63° 50′ N.; 167° 21′ W. (well north in Bering Sea), 17 fathoms; a half dozen, small (immature?) specimens, probably, though not certainly, of this species, from Kyska Harbor, Alaska, 14 to 9 fathoms, sandy bottom, collected by W. H. Dall in 1873; also one small individual, probably this species, from Constantine Harbor, Alaska, 6 to 10 fathoms, sandy and stony bottom, collected by Doctor Dall in 1873; one specimen Arctic Ocean, 66° 45′ N.; 166° 35′ W., 10 fathoms, W. H. Dall collection, August, 1880.

MOLGULA SIPHONALIS Sars.

Molgula siphonalis M. Sars, 1858, p. 65.—Kiaer, 1893, pp. 77, 101; pl. 4, figs. 37–40.—Hartmeyer, 1903, p. 157; 1909*a*, p. 1323.

So far as external characters are concerned, the single specimen under examination agrees so well with descriptions of *M. siphonalis* as to raise no question about the identification. And the two superficial characteristics of the species, namely, the long atrial siphon and the long hair-like processes of the test, being, as Hartmeyer has remarked, so unique, there can be little doubt, in spite of the slight obstacle presented by the branchial sac, to be noted presently, that Sars's Norwegian species is represented in Bering Sea.

The number of longitudinal vessels of the branchial sac is rather large in our specimen to be regarded as an individual variation of the number given by Kiaer for *siphonalis*. The scheme of vessels in our individual is as follows:

$$\text{Endostyle}\begin{cases}0\text{–}\mathit{3}\text{–}0\text{–}\mathit{8}\text{–}0\text{–}\mathit{9}\text{–}0\text{–}\mathit{10}\text{–}0\text{–}\mathit{10}\text{–}0\text{–}\mathit{10}\text{–}0\text{–}\mathit{9}\text{–}0\ \text{L.}\\0\text{–}\mathit{6}\text{–}0\text{–}\mathit{6}\text{–}0\text{–}\mathit{9}\text{–}0\text{–}\mathit{8}\text{–}0\text{–}\mathit{5}\text{–}0\text{–}\mathit{5}\text{–}0\text{–}\mathit{6}\text{–}0\ \text{R.}\end{cases}$$

For *siphonalis* Kiaer gives: 0–*5*–0–*6*–0–*6*–0–*5*–0–*5*–0–*5*–0–*4*–0 //=36, with no statement as to whether this is right or left. But since in all other points of internal structure the agreement is very close, this difference in the vessels ought not, I think, to stand in the way of the identification.

One specimen, *Albatross* No. 3560, latitude 56° 40′ N.; longitude 169° 20′ W. (near St. Paul Island), 43 fathoms, fne. gy. s. bk. sp., September 3, 1893.

EUGYRIOIDES DALLI, new species.

Plate 33, figs. 1–3.

Superficial characteristics.—Quite regular in form, varying from nearly spherical to oblong; siphons conspicuous because of their opaque whiteness as contrasted with the transparency of the test generally; projecting distinctly, though not greatly above the general surface, considerably harder than the rest of the body, so that the general appearance of the structures is that of two warts; the siphons rather near together, the atrial more toward the end of the body in oblong individuals. Test transparent, permitting the internal organs to be distinctly seen where the adhering sand grains (abundant in some individuals) are not too numerous. A great number of fine, flaccid filaments on the surface of the test, these almost uniformly distributed over the whole body. Animals unattached, apparently living on sandy bottoms. Largest individual about 30 mm. in diameter and nearly spherical; most individuals smaller. Mantle rather thin, musculature not strongly developed. Radial fibers much larger and stronger than circular, the former reaching back radially from each siphon not quite to the equator of the body; regularly spaced.

Respiratory system.—Branchial orifice 6-lobed, atrial 4-lobed, both sets of lobes rather obscure. The small lobes of the branchial orifice irregularly notched (pl. 33, fig. 1). Branchial tentacles about 50 of various sizes, about 12–15 large ones; sparsely and very irregularly branched, secondary branches being present though scarcely more than buds (fig. 2). Hypophysis mouth round, horseshoe-shaped, turned strongly to the right, the ends of the shoe simple, approaching each other rather closely. Ganglion very close to the hypophysis. Dorsal lamina undivided, smooth. Branchial sac without folds, but with seven prominent, longitudinal membranes occupying the position of the folds, each of these having a thickened, rounded edge which may be regarded as a single longitudinal vessel. Stigmata mostly strongly curved and disposed in infundibula which are of two orders, those with apices along the longitudinal vessels and those between the vessels and so with apices entirely independent of the vessels (pl. 33, fig. 3).

Alimentary system.—Situated on the left side, the whole forming roughly a semicircle with a double periphery from the intestines bending back rather sharply on itself, and so making the rectal portion run for some distance nearly parallel to the esophagus and stomach. Stomach not distinctly set off from the intestine, its wall thrown into a number of large irregular convolutions (pl. 33, fig. 1). (The course of the intestinal canal in the specimen here figured is not quite typical in that the space left between the two limbs at the point of doubling back is wider than usual.)

Reproductive system.—On both sides, consisting of intermingled lobes—not numerous—of ovary and testes; most of the left gonad situated within and in front of the intestinal loop.

The species is undoubtedly closely akin to *Eugyrioides arctica* Bonnevie, 1896; in fact, resembles it so closely that I have hesitated about making a separate species. However, as the descriptions of *arctica* now stand, the two differ in the following particulars: *dalli* grows to a considerably larger size than *arctica*. The latter is devoid of the surface filaments that are characteristic of *dalli*. The branchial tentacles of *arctica* are described by Bonnevie as being "lobed like an oak leaf." As my figure 2 shows, this is quite different from the tentacles of *dalli*. Finally the wide separation of the two geographically makes a presumption against their specific identity.

The specimens of *E. rara* (which see) were mingled with those of *dalli* in one of the bottles from Kyska Harbor, and a complete separation of the two without dissection of every one is somewhat doubtful. The superficial characters on which I have relied in sorting them are the more prominent and wartlike siphons, somewhat farther apart, of *E. dalli*. But since the differences here are neither great nor entirely constant, it is not impossible that more dissections would find that my sorting is not altogether accurate. As the evidence now stands *E. dalli* reaches a much larger size than does *rara*. This criterion, I suspect, will hold, but too much reliance should not be placed upon it till more evidence is at hand. The particular internal differences between these two species are the larger number of longitudinal vessels or membranes in *dalli;* the larger, more numerous and more highly branched tentacles of *dalli;* and the second order, or "free" infundibula of the branchial sac of *dalli*. These infundibula are a very striking feature of the inner surface of the respiratory membrane. They are of different sizes, are irregularly distributed, and make the impression, when seen under a low magnification, of foreign bodies of some sort clinging to the membrane.

Special mention should be made of the hundred and more small, excessively sand-covered individuals contained in one of the Kyska Harbor lots. I assume them to be the young of *dalli*. For one thing, the siphons, though recognizable on surface views of most of the individuals by their light color, are far less prominent either in color or in size than in the larger specimens. But differences in stage of development may well account for the difference. The siphons are also on the whole relatively farther apart in the smaller than in the larger individuals. This, however, is by no means invariably true, so I can not consider the peculiarity to be of great significance for classificatory purposes. In internal structure the tentacles of the small animals seem to be simpler, the secondary branches being wholly or almost wholly wanting. But this again may well be a juvenile deficiency. On the whole there is little question about the identification of the small specimens.

The collection contains several lots of this species, all but one obtained by Dr. W. H. Dall. One lot of three individuals is from Chichagof Harbor, Attu, Alaska, 5 to 7 fathoms, gravel and sand bottom, 1873. Three lots, containing over 200 specimens, many very small, from Kyska Harbor, also from the Aleutian Island region, 7 to 12 fathoms; and still another lot of 5 large, very sandy individuals from Kyska Harbor (type-locality). A half dozen specimens, *Albatross* station 3637, 57° 06′ 30″ N.; 170° 28′ W., 32 fathoms, crs. g., July 18, 1896.

Type.—Cat. No. 5678 U.S.N.M.

A bottle labeled "Kyska Harbor, 9–12 fathoms, 1873," of the Alaskan collections by W. H. Dall, contains about 35 specimens which externally much resemble the specimens from the same locality which I have regarded as the young of *Eugyrioides dalli.* The only difficulty, so far as surface appearances go, in thus disposing of these is the fact that no siphons or orifices can be seen on them, while the young *E. dalli* show the siphons in almost all cases, as already described. But dissection of the animals discovers a remarkable state of things. Besides the siphons and some of the mantle immediately adjacent to these, no ascidian organs can be made out. In most specimens examined a large number of spherical, amber-colored, semitransparent hard bodies are present. These, one would say offhand, are eggs, and such they may be; but no nuclei or other structures characteristic of ascidian eggs are recognizable. Aside from these ova-like bodies, the material filling the test (for such the sand-covered outer coat seems undoubtedly to be) consists partly of a dark, hard, amorphous mass, and two, generally irregular, elongated, granular, dull, white bodies. As to what all this means I can offer only the most dubious conjecture. The materials described call to mind what has been regarded by several observers and what I myself have seen some of, in some of the social and compound ascidians, as reserve material in a degenerative or hibernating state of the colonies, this to be made use of as food in the rejuvenation of the colony. But such a thing is wholly unknown, so far as I am aware, in simple ascidians, and I consider the suggestion as of barely sufficient probability to make it worth mentioning pending an opportunity of further examination.

EUGYRIOIDES RARA (Kiaer).

Paramolgula rara KIAER, 1896, p. 17, pl. 5, figs. 16–19.—HARTMEYER, 1903, p. 132.—REDIKORZEW, 1907, p. 3.

Eugyrioides rara HARTMEYER, 1909*a*, p. 1321.

There are about 30 specimens from Kyska Harbor mingled with *E. dalli,* which I assign to Kiaer's species, hitherto known only from the coasts of Norway and European Siberia. There is no difficulty that seems to me of consequence in the way of the identification. The tentacles of *rara* are "almost unramified," according to Kiaer, the branches being only "small buds." This description does not quite apply to my specimens, since the branches, though small and simple, are more than buds. Again, Kiaer speaks of the dorsal lamina as being "very powerful and high." This structure in the specimens now under consideration is undoubtedly wide for an ascidian of this size, but not excessively so. At first I was inclined to identify the specimens with *E. symmetrica* (Drasche, 1884, p. 161), a species very close of kin to *rara*. But the form of the infundibula and of the intestinal bend seems decisive, the infundibula of *symmetrica* being flat, while in *rara* they are distinctly elevated. In the "wide rapidly rising look" of the intestine, too, the Alaskan specimens agree closely with *rara*. It should be mentioned, however, that in the number of stigmata to each infundibulum our specimens seem to correspond more nearly with *symmetrica*, the number being at least 8 in ours, whereas 6 or 7 is the number for the typical *rara*. But this disagreement does not seem to me to go far toward offsetting the agreements above mentioned.

Specimens collected by W. H. Dall at Kyska Harbor, Alaska, 9 to 12 fathoms (No. 1000).

RHIZOMOLGULA RITTERI Hartmeyer.

Rhizomolgula ritteri HARTMEYER, 1903, p. 168, pl. 6, fig. 1; pl. 9, figs. 5–9.—HARTMEYER, 1909*a*, p. 1321.

Comparison of the numerous specimens of this species in the collection with *R. arenaria* Ritter, reveals the following well-marked differences: The sand coating of *arenaria* is distinctly thicker than in any of the specimens of *ritteri*, where at its minimum the sandiness is sparse, leaving considerable areas of the test entirely exposed. The mantle musculature, particularly the bands radiating from the orifices, is much stronger in *arenaria*. The branchial folds are higher in *arenaria*, the number of longitudinal vessels on them being somewhat greater. Hartmeyer has pointed out all these differences, except that of the difference in extent of the sand covering. He also notices the apparent absence of stigmata between the folds of *arenaria* as being distinctive. I have to correct my description of *arenaria* by stating that stigmata do occur between the folds. They are, however, fewer as compared with those in the folds than in *ritteri*, and are disposed more definitely in spirals and low infundibula. In no instance have I seen them in the serpentine partly coiled form characteristic of these stigmata in *ritteri*.

Albatross stations: 3229, 8 fathoms, 58° 40′ N.; 157° 15′ W. (Bering Sea), May 31, 1890, 80 specimens.—3266, 24 fathoms, 55° 08′ 30″ N.; 163° 30′ 30″ W. (Bering Sea), June 25, 1890, 50 specimens.—

3271, 25 fathoms (very near station 3266).—1 specimen, Granite Cove, Port Althorp, June 18, 1880, Dall collection.—1 specimen Chamisso Harbor, Eschscholtz Bay, Alaska, 5 to 8 fathoms, W. H. Dall, 1880.

HALOCYNTHIA WASHINGTONIA, new species.

Plate 33, figs. 4–6.

Superficial characters.—Somewhat egg-shaped, the thick end forward; attached along whole ventral side, the area of attachment much flattened and bordered by a distinct but irregular flange, the test here smooth and thin as compared with that of other regions; surface marked by a number of low, rather regular wrinkles generally running lengthwise of the body (pl. 33, fig. 4). Siphons not prominent, the branchial situated well forward, the atrial more prominent than the branchial, situated near the median dorsal line and about midway between the two ends; branchial orifice four-lobed, atrial obscurely six- or seven-lobed. Color dark brown, except area of attachment, which is dull gray. Test stiff and dense, scarcely thicker than heavy paper generally, still thinner over area of attachment. Length 2 cm., width 1.5 cm. Mantle rather thin, even for this genus, radial muscle fibers around and adjacent to the siphons as usual much the stronger, the circular fibers being very fine, especially on the ventral half of the body.

Respiratory system.—Tentacles 26 large ones, and about as many more very small ones, a few of the large being still larger than the others, the larger copiously branched; branchial membrane with six folds on each side, from 10–18 longitudinal vessels on the folds and generally 2 between the folds. Stigmata straight, long, and regular, about 6 in a mesh; dorsal languets of reddish color, those at posterior end of series somewhat longer. Hypophysis mouth simple, horseshoe-shaped, the opening directed forward.

Alimentary system.—On the left side, the rather wide loop occupying a nearly vertical position well toward the posterior end; stomach hardly distinguishable from the intestine in size; the lobulated gland (liver?) in two widely separated sections, one much more voluminous and elaborately branched than the other (pl. 33, fig. 6).

Reproductive system.—On both sides, left wholly within intestinal loop; about 35 hermaphroditic lobes on right and 30 on left, lobes on each side not crowded together, all connected to a common strand probably containing both oviduct and vas deferens.

The most unique feature about this species is the lobing of the atrial orifice. Exactly how many lobes are present in the one specimen at hand is not certain, but there are clearly five and these do not make up the complete circuit (fig. 5). I know of no other species of the genus to which more than four lobes of either orifice have been ascribed According to the older valuation of the lobes the present individual would, therefore, probably be counted as the type of a new genus. However, the animal is a very typical *Halocynthia* in all other respects, so I have no hesitation in placing it here.

Within the genus it belongs among the species with six branchial folds, its nearest of kin seeming to be *H. michaelseni* Oka, 1906, and *H. karasvoja* Oka. But from both of these it differs in several ways in addition to its larger number of atrial lobes. For example, *michaelseni* has about 10 vessels to the fold and 9 between, while the hypophysis mouth is described by Oka as presenting a "kompliziertes Muster." A very simple U-shape characterizes the organ in *washingtonia*. Furthermore, in the Japanese species the "liver" does not seem to be separated into the two distinct portions as is the case in *washingtonia*. In fact, this condition of the organ is rare for the genus.

Type-locality.—A single specimen, *Albatross* station 3450, lat. 48° 26′ 50″ N.; long. 124° 39′ 35″ W. (in the Strait of Juan de Fuca), 151 fathoms, bottom g., August 28, 1891.

Type.—Cat. No. 5680, U.S.N.M.

HALOCYNTHIA HAUSTOR (Stimpson).

Cynthia haustor STIMPSON, 1864, p. 159.—VON DRASCHE, 1884, p. 372, pl. 3, figs. 3 and 8.—HERDMAN, 1898, p. 257, pl. 14, figs. 1, 2.—RITTER, 1900, p. 601, pl. 18, figs. 8, 9, 10.

Pyura haustor HARTMEYER, 1909*a*, p. 1340.—HUNTSMAN, 1911, p. 134.

There are a dozen and a half of this common Puget Sound species sent to the museum by Dr. O. B. Johnson in 1889. They were collected from shore rocks between tides and show nothing needing comment.

Puget Sound, Dr. C. B. Kennerly, Northwestern Boundary Survey, 25 specimens, cotypes.

The assignment to this species of two small specimens from *Albatross* station 3451 is open to some though but little doubt. Perhaps the most questionable point is the almost entire absence of siphons in these specimens, these structures being usually though not always particularly prominent in the typical *haustor*. The ridging and tuberculation of the test of the individuals now under consideration are furthermore somewhat less definitely expressed than in *haustor* from the littoral zone. The available evidence from internal structure contains nothing against the identification excepting possibly the tentacle number, which is here 30, somewhat high for *haustor*. What makes the assignment of these specimens particularly interesting is the fact that they were taken in much deeper water, 106 fathoms, than *haustor* generally inhabits.

Albatross 3451, lat. 48° 25′ 10″ N.; long. 124° 37′ 50″ W., in the Strait of Juan de Fuca, 106 fathoms, August 28, 1891.

Type.—Cat. No. 3239, U.S.N.M.

HALOCYNTHIA HAUSTOR FOLIACEA, new subspecies.

Plate 33, fig. 7.

The specimens of *Halocynthia* which I am considering, provisionally, as a subspecies of *H. haustor* stand, according to the evidence now at hand, about midway in their resemblances between *H. johnsoni* and *H. haustor* with features sufficiently different from both to entitle them to independent specific rank should the examination of more material establish the constancy of the characters used for separating them as a subspecies.

The strikingly distinctive features about them pertain to the general external appearance. Irregular in form as individuals of both *johnsoni* and *haustor* usually are, the animals now before me are far more so than anything I have ever seen in these species. The irregularity is due chiefly to the extent and character of the outgrowths on the test. Some of these, particularly on the siphons and toward the anterior end of the body, are quite remarkable, being long, more or less flattened,and broadest at the distal end. They may reach a length of nearly 12 mm. and these largest longest ones are quite flexible or pendulous. They might properly be spoken of as foliaceous (pl. 33, fig. 7). On portions of the body where there are no such elaborate outgrowths the test is still deeply, though irregularly corrugated, the sharply projecting ridges being clearly of the same general nature as the foliaceous warts. In these regions the surface is not greatly different from that of the typical *haustor*.

The color is dark brown, the processes and higher ridges inclining to reddish.

On the whole the animals appear to be shorter in proportion to the greatest transverse diameter than is either *haustor* or *johnsoni*, though in proportions, as well as in surface features, the irregularity is very great.

The height, exclusive of the siphons and processes, of the specimen shown in figure 7 is about 2 cm., and the greatest transverse diameter is 3.5 cm. But some of the individuals are higher proportionally.

In external characters the animals undoubtedly resemble *haustor* more than they do *johnsoni*.

On the other hand, as regards the one internal feature to which, so far as is now known, *haustor* and *johnsoni* are distinct from each other, namely, the tentacle number, the specimens now under consideration resemble more *johnsoni*. In four specimens examined the numbers counted were 34, 30, 28 or 30, and 26, the last being a small individual. The average number for typical *haustor* is about 21, while the average for *johnsoni* is 42.

The scheme of internal longitudinal vessels for the right side of two specimens was:

First. D. L. ?–*9*–3–*21*–1–*21*–1–*23*–5–*18*–3–*11*–2 = 118.

Second. D. L. ?–?–2–*20*–3–*18*–2–*16*–7–*12*–6–*12*–3 = 101.

Neither these series nor those of other specimens counted indicate anything distinctive in comparison with either *haustor* or *johnsoni;* and the same remark must be made concerning the other internal systems—with the possible exception of the "liver." This structure is not large in our animals and an extensive comparative study of it might, perhaps, prove it to present constant differences.

Type-locality.—Albatross 3088, lat. 44° 28′ N.; long. 124° 25′ 30″ W., 46 fathoms (close to the Oregon coast), September 3, 1889.

Type.—Cat. No. 5681, U.S.N.M.

HALOCYNTHIA AURANTIUM (Pallas).

Ascidia aurantium Pallas, 1787, vol. 2, p. 240, pl. 7, fig. 38.
Cynthia pyriformis Dall, 1872, p. 157.
Cynthia superba Ritter, 1900, p. 590, pl. 18, fig. 1; pl. 19, figs. 16, 17, 18, and 20; pl. 20, fig. 19.
Cynthia deani Ritter, 1900, p. 592, pl. 18, figs. 2, 3; pl. 19, figs. 21, 22, 23.
Halocynthia aurantium Hartmeyer, 1903, p. 195.
Halocynthia superba Oka, 1906, p. 41.
Pyura aurantium Hartmeyer, 1909*a*, p. 1339.
Tethyum aurantium Huntsman, 1911, p. 136.

For full synonymy see Hartmeyer, 1903.

Table 7 gives the tabulated result of the examination of 26 specimens of the *aurantium* group of *Halocynthia* representing the full extent of the geographic range of the group. Study of this table shows that the specimens from the Pacific Ocean and Bering Sea are undoubtedly separable from those of the Atlantic Ocean by the number of gonads and probably also by the ratio of length to thickness of the individual animals, and the character of the spines of the test.

TABLE 7.

No. of specimen.	Collector.	Locality.	Depth in fathoms.	Size. L.	Size. D.	Size. Ratio L./D.	Lobes of orifices. B.	Lobes of orifices. A.	Spines on test in circles or not. Yes.	Spines on test in circles or not. No.	Tentacles.	Folds of sac. R.	Folds of sac. L.	Longitudinal vessels of sac.	Total vessels.	Average vessels on folds.	Average vessels between folds.	Stigmata in mesh.	Gonads. R.	Gonads. L.
1	*Albatross* 3505.	Bering Sea....	44	13	7.5	1.73	4	?	×	....	24	9	11	R. 4-26-4-34-4-34-3-30-3-30-3-28-3-25-3-16-2-4-1. L. 3-28-4-30-4-31-2-28-4-29-2-27-3-21-2-14-2-4-1.	257 239	24.4—	2.8+	15	2	3
[1] 2	Columbia Univ. Exp.	Puget Sound..	Shore.	12	6	2.00	2	18	×	....	18	8	10	R. 2-23-3-25-3-24-6-22-6-22-3-23-3-18-2-8-2.... L. 3-21-4-26-3-27-3-27-?-25-3-20-2-13-2-6......	195 185	20.4	3.1+	8-16	7?	3?
[2] 3	Alaska Commer. Co.	Alaska........	?	10	4	2.50	4	4?	×	....	26	9	10	R. 1-17-0-26-2-31-1-28-1-27-0-27-1-22-3-14-3-10-3. L. 0-21-1-29-2-28-1-27-0-27-3-17-2-16-0-15-0-4-1.	217 194	21.4+	1.25	9	3	4 or 5?
4	*Albatross*......	Unalaska......	?	9.5	7	1.36	4?	4?	×	....	24	8	10	R. 3-31-4-32-6-32-3-30-4-26-3-22-3-18-3-10-0... L. 3-27-3-34-0-35-0-29-3-27-3-26-2-21-0-14-0...	230 227	25.9—	2.4—	15-17	3	2
5	T. H. Streets..	Kasaan Bay ..	?	8	5	1.60	4	4	......	×	30	9	11	R. 2-14-4-24-0-28-1-28-3-23-3-20-4-17-3-14-2-5-1. L. 0-21-0-28-2-27-2-25-3-21-3-20-3-18-2-6-0....	196 181	20.0—	2.0	7-18	3	2
[3] 6	C. M. Coffin...	Grand Banks.	....	8	5	1.60	4	?	......	×	27	8	10	R. 0-19-3-25-1-26-3-25-3-24-3-20-4-17-2-10-0... L. 0-21-0-29-2-29-2-23-2-22-1-21-0-17-0-13-3...	185 185	21.3+	1.6—	12	7	6
7	*Albatross* 3213.	S. of Alask. Pen.	41	7	3.5	2.00	4	?	×	....	27	8	10	R. 3-21-3-21-1-25-3-23-3-19-4-20-4-17-4-7-2.... L. 1-25-1-25-1-28-2-27-2-23-3-20-3-15-2-6-2....	180 186	20.1+	2.45+	6-10	2	4
8	*Albatross* 3513-b.	Bering Sea....	35	6.5	5	1.30	4	?	×	....	29	9	10	R. 1-14-3-27-0-27-1-26-2-22-2-26-3-16-3-13-1-7-0. L. 0-22-3-22-1-28-2-25-3-23-3-20-3-18-5-9-1....	194 188	20.3—	1.9+	15	3	3
[4] 9	N. Pacific Explor. Exp.	Arctic Ocean..	?	6.5	4.3	1.51	4	?	×	....	24?	?	?	?	?	?	?	Many.	?	?
[4] 11	*Albatross* 2442.	Off Newfoundland.	33	6	6	1.0	4	4	......	×	24	9	9	R. 2-13-3-23-2-23-3-24-2-24-2-23-1-17-1-13-1-3-0 L. 2-16-3-23-2-26-2-18-2-21-2-17-3-16-2-9-1-7-1	180 173	17.6—	1.85—	15	5	7
12	T. H. Streets..	Ward Cove....	?	6	3.5	1.71	4	2	×	....	31	8	10	R. 0-15-2-23-2-23-1-20-2-17-2-17-3-12-2-5-2.... L. 3-16-3-24-0-24-2-24-1-18-3-15-3-11-3-6-1....	148 157	16.9—	1.9+	16	3	3
[5] 13	W. Stimpson..	Eastport and Gr. Manan.	....	5.5	4.5	1.22	4	4	......	×	22	8	9	R. 3-10-7-20-4-20-3-19-4-19-3-15-3-14-0-4-0.... L. 0-16-4-16-5-20-3-21-3-18-4-19-3-14-2-4-2....	148 154	15.6—	2.9+	19	5	7
14	*Albatross*......	Kodiak.......	....	5.5	3.5	1.57	4	4	×	....	27	8	9	R. 2-16-2-23-2-22-1-22-2-20-1-21-1-12-2-5-1.... L. 1-19-0-22-2-22-2-21-2-19-1-16-2-13-2-4-2....	155 150	17.3+	1.6—	15	3	4?
15	*Albatross* 2842.	Akutan Id....	72	5	2.2	2.27	4	4	×	....	23	8	9	R. 0-20-1-21-1-23-1-18-1-10-1-16-1-13-2-3...... L. 0-17-2-21-2-22-0-19-2-20-2-19-2-8-1.........	141 137	17.3—	1.2—	14	3	4

[1] Name previously applied, *Cynthia superba* (type).
[2] Name previously applied, *Cynthia superba*.
[3] Name previously applied, *Halocynthia pyriformis*.
[4] Name previously applied, *Cynthia pyriformis*.
[5] Name previously applied, *Halocynthia pyriformis*.

TABLE 7—Continued.

No. of specimen.	Collector.	Locality.	Depth in fathoms.	Size. L.	Size. D.	Size. Ratio L./D.	Lobes of orifices. D.	Lobes of orifices. A.	Spines on test in circles or not. Yes.	Spines on test in circles or not. No.	Tentacles.	Folds of sac. R.	Folds of sac. L.	Longitudinal vessels of sac.	Total vessels.	Average vessels on folds.	Average vessels between folds.	Stigmata in mesh.	Gonads. R.	Gonads. L.
16	Dall (1455)....	Chugachik....	20–60	4	2.7	1.48	4	4?	×	....	30	7	9	R. 1–9–2–16–0–17–2–17–1–17–4–16–2–10–0......... L.	114	14.6–	1.5	14	3	4 or 5
17	No label	....	?	4	2.25	1.78	4	4?	×	....	25	7	?	R. 1–9–4–15–1–16–1–15–1–17–1–13–1–9–2.......... L.	103	14.1+	1.1+	7–13	3	4
[1]18	Young Naturalist Club, Seattle.	Puget Sound..	?	3.8	2.2	1.73	4	4?	×	....	26	8	9	R. 1–10–1–16–1–16–1–16–1–15–1–12–1–7–0–2–1..... L.	102	11.8–	.9–	19	3	?
[2]19	*Albatross* 2439.	Off Newfoundland.	?	3.5	3.3	1.06	4	4?	Few.	....	25	...	9	R. 2–14–3–22–2–21–2–21–2–19–2–18–2–13–2–7–2–4–1 L. 2–11–4–20–2–21–2–20–3–19–3–17–4–13–2–8–1–4–0	159 162	15.4+	2.15	....	7	7
[3]20	Zool. Station, Naples.	Naples........	....	2.3	1	2.3	4	?	......	×	23	9	8	R. 3–9–1–15–1–17–1–18–1–17–1–15–2–13–3–12–1–6–2 L. 0–3–1–11–1–15–1–24–0–19–1–15–2–19–2–19–1–14–2–4–1.	138 155	13.9+	1.3+	15	2	2
[4]21	W. Stimpson..	Eastport and Gr. Manan.	....	3.25	2	1.13	4	4	......	Not distinct.	17	8	8	R. 0–13–2–18–2–18–2–18–2–15–2–14–1–11–0–6–0.... L. 2–11–2–19–2–17–2–17–1–14–1–12–2–11–0–4–0....	134 117	13.6+	1.3–	15	11	11
[6]23	Columbia Univ. Exp.	Puget Sound..	?	2	1	2.0	4	?	×	....	16	7	8	R. 0–7–0–11–1–10–2–9–3–10–3–7–0–3–3............ L. 3–8–1–6–2–8–3–6–3–6–0–3–1.................	69 50	7.2+	1.7–	13	2	2
24	F. M. Chamberlain.	Loring........	....	1.7	1.2	1.41	4	?	×	....	22	7	8	R. 2–0–9–1–12–2–10–2–10–1–10–0–6–1.............. L. 6–1–11–0–15–2–11–1–10–0–8–0–4–0.............	56 69	8.9–	.79–	12	2	2
25	*Albatross*......	Unalaska and Cook Inlet.	42	1.5	.7	2.14	4	?	×	....	16+	7	?	R. 0–5–1–10–0–14–1–12–1–10–0–11–0–9............	74	10.1+	.4+	3–6	?	?
26	.....do........	Loring........	....	1.2	.9	1.33	4	?	×	....	32	7	6	R. 2–0–6–0–10–0–9–1–8–1–5–2–2................... L. 3–0–7–0–8–1–9–1–7–0–4–2–1.....................	46 43	5.9+	.5	13	2	2

[1] Name previously applied, *Cynthia deani.*
[2] Name previously applied, *Cynthia pyriformis.*
[3] Species, *Halocynthia papillosa = Cynthia papillosa.*
[4] Name previously applied, *Halocynthia pyriformis.*
[6] Name previously applied, *Cynthia deani.*

Table 8, made by arranging the specimens on the basis of the number of gonad lobes, brings out the fact that all the Atlantic specimens (5) fall into a group with 12 or more gonads, while all the Pacific-Bering Sea specimens (16), with one exception, fall into a group having 8 or fewer gonads. This result is in agreement with Huntsman's conclusion that the Pacific animals have fewer gonads than have those from the Atlantic-Arctic region, and favors the recognition of two specific groups. Whether a single difference ought ever to be considered sufficient for separating species may be a question; but when, as in this case, it is associated with one or more other highly probable differences there should be no hesitation. As shown by Table 7, it is almost certain that the spines of the test are arranged in circular groups more definitely in the Pacific animals. The greater average ratio of length to diameter shown by the Pacific specimens—1.77:1 as against 1.20:1 for the Atlantic animals—is likely to prove a good character also, but the distorted condition of many of the preserved specimens makes measurement rather unsatisfactory.

Since the specimens upon which Pallas based his *Ascidia aurantium* were from the Kurile Islands, that specific name will stand for the Pacific animals, and the name of the Atlantic species will be *H. pyriformis* (Rathke.)

TABLE 8.

Data of the Aurantium group of Halocynthia arranged with reference to the number of gonads and bringing out the distinctness of H. pyriformis from H. aurantium.

No. of specimen.[1]	Gonads.	Ratio of width to length of individual.	Arrangement of spines on test.	Tentacles.	Folds of sac.	Average vessels per fold.	Locality.	
6	*13*	1:1.6	No circles	27	8	23	Grand Banks.	*H. pyriformis.*
11	*12*	1:1	do	24	9	19.6	Newfoundland.	
13	*12*	1:1.2	do	22	8	19	Grand Manan.	
19	*14*	1:1.06	Few circles	25	9	18	Newfoundland.	
21	*15*	1:1.13	No circles	17	8	15.7	Eastport.	
Average	*13.2*	1:1.2		23	8	19	All Atlantic stations.	
1	*5*	1:1.73	Circles	24	9	27.6	Bering Sea.	*H. aurantium.*
2	*10*	1:2	do	18	8	23.8	Puget Sound.	
3	*8*	1:2.5	do	26	9	23	Alaska.	
4	*5*	1:1.36	do	24	8	28.6	Unalaska.	
5	*5*	1:1.6	No circles	30	9–8	22	Kasaan Bay.	
7	*4*	1:2	Circles	27	8	23	South of Unimak.	
8	*6*	1:1.3	do	29	9–8	21.3	Bering Sea.	
12	*6*	1:7	do	31	8	19	Ward Cove, Alaska.	
14	*7*	1:1.57	do	27	8	18	Kodiak, Alaska.	
15	*7*	1:2.27	do	23	8–7	18.6	Akutan Id.	
16	*8*	1:1.48	do	30	7	16.3	Chugachik, Alaska.	
23	*4*	1:2	do	16	7–6	9	Puget Sound.	
24	*4*	1:1.4	do	22	7	9.6	Loring, Alaska.	
26	*4*	1:1.33	do	32	7	6.4	Do.	
Average	*6*	1:1.77		23	8	19		

[1] The numbers correspond to the numbers of the individuals in Table 7.

The variation of the hypophysis should be mentioned, since it is impossible to present this in the table. In small individuals the hypophysis mouth is generally broadly horseshoe-shaped, the horns being rolled in at the tips to the extent of one or two turns. With increase of size this simple condition is lost, seemingly in all cases, the inrolling of the horns progressing to form spirals having four, five, or more turns. In some cases these spirals remain flat, but in others they take on a cone shape, the cones in some projecting prominently. Frequently secondary cones are formed on various parts of the tubercle, in one instance as many as seven of different sizes being present. The range of variation and complication is here somewhat similar to but greater than that found in *H. johnsoni* Ritter, 1909.

"*Albatross*" COLLECTIONS.

Station 2842, lat. 54° 15′ N.; long. 166° 03′ W., off Akutan Island, Alaska, 72 fathoms, p., July 23, 1888, 1 specimen.

Station 2851, lat. 54° 55′ N.; long. 159° 52′ W., Shumagins, 35 fathoms, gy. s. brk. sh., August 4, 1888, 3 specimens.

Station 3213, lat. 54° 10′ N.; long. 162° 57′ 30″ W., southwest of Sannak Islands, 41 fathoms, bk. s., May 21, 1890, 2 specimens.

Station 3504, lat. 56° 57′ N.; long. 169° 27′ W., Bering Sea, 34 fathoms, fne. gy. s. bk. s., July 28, 1893, 3 specimens.

Station 3505, lat. 57° 09′ N.; long. 168° 17′ W., Bering Sea, 44 fathoms, fne. gy. s., July 28, 1893, 15 specimens.

Station 3512, lat. 57° 49′ 30″ N.; long. 169° 27′ W., Bering Sea, 38 fathoms, fne. s. gn. m., August 1, 1893, 1 specimen.

Station 3513, lat. 58° 27′ N.; long. 169° 01′ W., Bering Sea, 35 fathoms, fne. s. gn. m., August 1, 1893, 2 specimens.

Unalaska, June 16, 1890, 2 specimens.

Kadiak, Alaska, August 14, 1888, 1 specimen.

Loring, Alaska, April 29, 1903, 5 specimens, small.

OTHER THAN "*Albatross*" COLLECTIONS.

Chugachik, Alaska, 20–60 fathoms, W. H. Dall, June 30, 1880, 1 specimen.

Chiniak Bay, Kodiak, Alaska, 16–25 fathoms, W. H. Dall, July 12, 1880, 1 specimen.

Unalaska, Alaska, L. M. Turner, October, 1878, 1 specimen.

Kasaan Bay, Prince of Wales Island, Alaska, T. H. Streets, 1 specimen.

Ward Cove, Revilla Gigedo Island, Alaska, T. H. Streets, 2 specimens.

St. Paul Island, Pribilof Islands, M. C. Marsh, Bureau of Fisheries, March, 1912, 1 specimen.

HALOCYNTHIA ECHINATA (Linnæus).

Ascidia echinata LINNÆUS, 1767, vol. 1, part 2, p. 1087, No. 6.
Cynthia echinata STIMPSON, 1854, p. 20.
Halocynthia echinata VERRILL, 1879, p. 148.
Halocynthia arctica HARTMEYER, 1903, p. 190, pl. 11, figs. 10, 11.
Halocynthia arctica REDIKORZEW, 1907, p. 130.
Pyura echinata HARTMEYER, 1910, p. 231, figs. 1–12.
Boltenia echinata HUNTSMAN, 1911, p. 133.
Pyura echinata VAN NAME, 1912, p. 523, text fig. 23, pl. 54, figs. 61–65; pl. 70, figs. 143, 144.

(For fuller synonymy, see Van Name, 1912.)

Thanks to Hartmeyer (1910) the delimitations of this species are now pretty well established.

The specimens at hand from Plover Bay belong, with little doubt, to this old species. Although the number of tentacles is high—about 18 or 20, while *echinata* is said to possess 12—the difference I do not believe to be specifically significant. The difficulty, rather common in this genus, of counting the tentacles; namely, of determining in some cases whether one has to do with a small tentacle proper or a basal branch of one of the large members of the circlet is encountered here. Examination of a specimen from Grand Manan off the Atlantic coast of North America, recognized as the home of *echinata*, convinces me that the tentacle number and scheme do not differ from those of the Bering Sea specimens more than they may between specimens from either locality. This is in full agreement with the recent description of the species by Hartmeyer and Van Name.

There are also three small specimens from Loring, Alaska, which I assign to this species, though with somewhat more hesitation than in the case of the Plover Bay animals. The spinulation of the Loring specimens is certainly not typical, only comparatively few of the spines presenting the regular ring of crowning secondary spines so characteristic of *echinata*. A majority of the spines resemble more closely the single axis spines of *H. villosa* and its congeners than the radical spines of *echinata*. However, the stellate variety does occur, particularly on one of the specimens; so on the whole I have not considered the difficulty here sufficiently great to invalidate the identification. Again, well-defined dorsal languets occur in the Loring animals, and this is perhaps a more serious obstacle in the way of assigning them to this species than is the departure from the type of the surface spines. But since the series of processes does not extend all the way back to the posterior end of the lamina, there is the same justification here as in the case of the Plover Bay animals for the assignment made.

Plover Bay, Siberia, 15 to 20 fathoms, W. H. Dall, 1880, 3 large specimens.

Loring, Alaska, Alaska Salmon Investigations, *Albatross*, Apr. 30, 1903.

A single specimen from Aberdore Channel east of Alger Island, Baldwin-Ziegler Polar Expedition, June, 1901.

A small specimen from *Albatross* station 3213, southwest of Sannak Islands, Alaska, 41 fathoms, is perfectly typical as to the spines. I am unable to determine the number of branchial folds, but there can be little or no doubt about the identification.

HALOCYNTHIA VILLOSA (Stimpson).

Cynthia villosa STIMPSON, 1864, p. 160.—HERDMAN, 1898, p. 258, pl. 12, figs. 7–11.
Pyura villosa HARTMEYER, 1909*a*, p. 1342.
Boltenia villosa HUNTSMAN, 1911, p. 134.

The only point in which the specimens at hand appear to differ from *H. villosa,* as redescribed by Herdman in 1898, is in the length of the peduncle. The individual figured by this author can scarcely be called pedunculate at all. In fact, Herdman speaks of the species as being "narrower at the posterior end and sometimes attached by a short stalk." Stimpson, however, states in the original description that the test at the point of attachment "is produced into a peduncle which is sometimes as long as the body is thick." In none of the specimens under observation is the peduncle shorter than the body is thick, and in most of them it is considerably longer. Judging, however, by other well-known pedunculated species, we would expect the structure to be subject to much individual variation in length, and hence would not, according to prevailing notions as to specific differences, regard the differences noted as of specific importance.

It is worth while to note that considerable variation occurs among the individuals in the number of branchial folds. One specimen had 7 folds on each side at the anterior end, and only 6 at the posterior end on the left side. A second specimen had 8 folds on the left, and 9 on the right, the ninth being small, while a third had 8 folds on each side.

The formula for the internal longitudinal vessels of a specimen from Loring, Alaska, was:

$$\text{Endostyle}\begin{cases}2\text{–}\mathit{5}\text{–}2\text{–}\mathit{13}\text{–}2\text{–}\mathit{17}\text{–}3\text{–}\mathit{20}\text{–}2\text{–}\mathit{20}\text{–}1\text{–}\mathit{15}\text{–}1\text{–}\mathit{22}\text{–}0 & \text{L.}\\ 2\text{–}\mathit{10}\text{–}1\text{–}\mathit{14}\text{–}1\text{–}\mathit{19}\text{–}2\text{–}\mathit{21}\text{–}2\text{–}\mathit{18}\text{–}1\text{–}\mathit{12}\text{–}1\text{–}\mathit{18}\text{–}1 & \text{R.}\end{cases}$$

A specimen from Puget Sound had the following:

$$\text{Endostyle}\begin{cases}1\text{–}\mathit{7}\text{–}2\text{–}\mathit{10}\text{–}3\text{–}\mathit{15}\text{–}3\text{–}\mathit{17}\text{–}4\text{–}\mathit{16}\text{–}3\text{–}\mathit{20}\text{–}2\text{–}\mathit{15}\text{–}1\text{–}\mathit{21} & \text{L.}\\ 1\text{–}\mathit{4}\text{–}2\text{–}\mathit{10}\text{–}3\text{–}\mathit{11}\text{–}3\text{–}\mathit{15}\text{–}4\text{–}\mathit{13}\text{–}7\text{–}\mathit{19}\text{–}5\text{–}\mathit{11}\text{–}6\text{–}\mathit{11}\text{–}6\text{–}\mathit{9} & \text{R.}\end{cases}$$

The Loring specimens are very uniform in external appearance and the echination is decidedly closer and longer than that of the specimens of *H. castaneiformis* with which I am familiar; Loring, Alaska, 3 to 4 fathoms, Alaska Salmon Investigations, April 30, 1903, 26 specimens.

Puget Sound, on rocks between tides, O. B. Johnson, July, 1889. The 22 specimens in the Puget Sound lot are somewhat less uniform among themselves in external form than the Loring ones. Some of them are almost without the peduncle, as was the one figured by Herdman, while in others the peduncle is quite as long as in the

Loring specimens generally. The echination of the Loring and Puget Sound specimens do not differ in any recognizable way.

Huntsman, 1911, asserts that he has collected specimens from one locality on the Canadian coast showing a range of variation so great as to include *H. villosa*, *H. castaneiformis* v. Drasche, and *Boltenia echinata* Ritter! The evidence for this we shall await with much interest.

HALOCYNTHIA CASTANEIFORMIS (v. Drasche).

Cynthia castaneiformis von Drasche, 1884, p. 373, pl. 2, figs. 9, 10.—Ritter, 1900, p. 599, pl. 18, figs. 6, 7; and pl. 19, fig. 25.
Pyura castaneiformis Hartmeyer, 1909*a*, p. 1339.

The single specimen in the collection that I identify as this species is from *Albatross* 3088, off the Oregon coast, lat. 44° 28′ N.; long. 124° 25′ 30″ W., 46 fathoms, bottom clay and pebbles, September 3, 1889.

The material is not sufficient to afford any new light on the interesting question of the relationships and distribution of the echinated group of Halocynthias. (See particularly Ritter, 1907, p. 12.)

The spines of the test are sparser and smaller in the specimen than is usual even for this species.

For the benefit of whoever may undertake the task at some future time of a critical study of this group I give the most important diagnostic features of the specimen at hand.

Branchial tentacles 33, rather large and well branched.

Folds of the branchial sac, 8 on each side.

Formula of longitudinal vessels:

$$\text{Endostyle}\begin{cases}0\text{–}\mathit{4}\text{–}2\text{–}\mathit{12}\text{–}2\text{–}\mathit{17}\text{–}1\text{–}\mathit{17}\text{–}0\text{–}\mathit{21}\text{–}0\text{–}\mathit{21}\text{–}0\text{–}\mathit{21}\text{–}1\text{–}\mathit{17}\text{–}1 \text{ L.}\\ 0\text{–}\mathit{4}\text{–}1\text{–}\mathit{11}\text{–}2\text{–}\mathit{16}\text{–}1\text{–}\mathit{17}\text{–}0\text{–}\mathit{23}\text{–}0\text{–}\mathit{23}\text{–}0\text{–}\mathit{13}\text{–}0\text{–}\mathit{16}\text{–}0 \text{ R.}\end{cases}$$

Stigmata transversely elongated, but a few scattered ones longitudinally elongated in the spaces between the regular series of transversely elongated ones.

Gonads, one elongated mass on each side.

HALOCYNTHIA OKAI Ritter.

Halocynthia okai Ritter, 1907, p. 11, pl. 1, figs. 9–16.
Pyura okai Hartmeyer, 1909, p. 1340.

The number of tentacles is high in the specimens at hand as compared with those of the species from the California coast, there being as many as 37 in one specimen, and in none observed has the number been less than 29. On the other hand, 16 is the number reported in the original description. Since, however, there is no other difficulty in the way of the identification, it is probably safe to assume that further study would increase the number in animals from the original locality and diminish that for animals from the more northern region.

Albatross 2877, lat. 48° 33′ N.; long. 124° 53′ W. (coast of Washington), 59 fathoms, bk. s. m., September 25, 1888, 2 specimens.

Albatross 3052, lat. 44° N.; long. 124° 57′ W. (coast of Oregon), 48 fathoms, co. brk. sh. rky., June 8, 1889, 1 specimen.

Albatross 3088, lat. 44° 28′ N.; long. 124° 25′ 30″ W. (coast of Oregon), 46 fathoms, c. p., September 3, 1889, 5 specimens.

A bottle with half a dozen specimens, no label. The unlabeled bottle is particularly unfortunate, since it contains the largest specimens of the collection, one being 8.5 cm. by 5.5 cm. Another is so much elongated fore-and-aft as to make it almost pedunculated, though the posterior part is but little narrower than the anterior.

HALOCYNTHIA JOHNSONI Ritter.

Halocynthia johnsoni Ritter, 1909, pp. 65–98, pls. 7–14, figs. 1–17 excepting 9 and 10.

There are 5 very poorly preserved specimens of this species taken in San Diego Bay by the *Albatross*, March 21, 1894.

I am now adding to the United States National Museum collection 10 specimens from San Diego Bay taken from piles during the summer (July or August) 1911.

BOLTENIA OVIFERA (Linnæus).

Vorticelli ovifera Linnæus, 1767, vol. 1, pt. 2, No. 14.
Ascidia clavata Müller, 1776, p. 226, No. 2740.
Boltenia ovifera Savigny, 1816, pp. 88, 140, pl. 1, fig. 1; pl. 5, fig. 1.
Boltenia reniformis MacLeay, 1825, p. 536, pl. 18, figs. 1–5.
Boltenia rubra Stimpson, 1852, vol. 4, p. 232.
Boltenia bolteni Rink, 1857, vol. 2, p. 104.
Boltenia beringi Dall, 1872, p. 157.
Boltenia elegans Herdman, 1882, p. 86, pl. 7, figs. 1–5.
Boltenia ovifera Hartmeyer, 1903, p. 173, pl. 4, figs. 11, 12; pl. 10, figs. 1–4.
Boltenia thomsoni Hartmeyer, 1903, p. 185, pl. 5, fig. 1; pl. 10, figs. 5–9.
Pyura ovifera Hartmeyer, 1909*a*, p. 1340.
Boltenia ovifera Huntsman, 1911, p. 133.
Pyura ovifera Van Name, 1912, p. 527, text fig. 24; pl. 55, fig. 66; pl. 56, figs. 68–70; pl. 67, fig. 133; pl. 70, fig. 145.

(This synonymy covers only names that have been used considerably in the literature and those which have been recently proposed. For fuller lists see Hartmeyer, 1903, and Van Name, 1912.)

Hartmeyer has done a good service in bringing something of order out of the chaotic state into which knowledge of this widely distributed, rather variable, and long-known group of ascidians had fallen. But it is significant of the diversity of character and deceitfulness, as one might say, of the animals that, after having shown the untenability of many of the hitherto recognized species, he should have been led to establish still another that will have to be assigned to the list of synonyms. We shall see presently that his *B. thomsoni* can not be accepted.

But valuable as Hartmeyer's studies of these animals are, I can not but think he has taken a backward step in proposing to suppress the genus name *Boltenia* (Hartmeyer, 1909), page 336, and to transfer all the species to *Halocynthia* (*Pyura*). His low valuation of the presence or absence of the peduncle as a generic mark undoubtedly has much justification, though it would be interesting to see what would result were the argument employed by him in this connection to be rigorously applied throughout the whole of zoology and botany. Without doubt a considerable percentage of all the genera now recognized would be set aside. But assuming that the mere presence of the peduncle is not sufficient to save *Boltenia*, there remains the distinctive position of the branchial orifice in relation to the insertion of the peduncle. Hartmeyer considers this also of little importance, instancing in support of his view the fact that in some genera, as *Molgula* (*M. crystallina*), the position of the orifices relative to the peduncle is similar to that in *Boltenia* and *Halocynthia*. That is, he points out a transition of character not between *these two genera* but between *Boltenia* and some other genus. This way of treating resemblances and differences between groups of organisms certainly would play havoc with our classifications if consistently carried out. Much depends on one's views as to what characters are superficial and what are fundamental. As I observe and think about organic structure, I am unable to see that organs and parts located on the surface and so observable without dissection are necessarily superficial in a biological or logical sense; nor contrariwise is the internal position of a part the essence of fundamentality. Ought it to be assumed, for example, that the digestive tract, because internally located and hence literally a fundamental anatomical organ, is therefore more constant and hence more reliable for grouping animals than is the peduncle? Not necessarily. It is, if observation proves it to be so; not otherwise. As a matter of fact, I believe it would be quite as difficult to prove that the peduncle present here and there among ascidians is any more adaptive than is the branchial sac, the intestine, or the renal organs. Renal organs are present in some groups of ascidians, but not in others. Are they fundamental anatomical parts or not? When one compares an intestine as voluminous and elaborate as that of *Styela macrenteron* (see p. 466) with one so diminutive and simple as that of *Styela thelyphanes* Sluiter, 1904, page 68, he can hardly be impressed with the constancy of this anatomical organ.

The collection contains many specimens of many sizes, so that my conclusions rest on rather ample observations, so far as north Pacific representatives of the species are concerned.

The accompanying table (Table 9) exhibits something of the range of variation of the species.

TABLE 9.

No. of specimen.	Collector.[1]	Locality.	Depth in fathoms.	Size of body. L.	Size of body. W.	Length of peduncle.	Surface of test.	Tentacles.	Folds of sac. R.	Folds of sac. L.	Longitudinal vessels of sac.	Total vessels.	Average vessels on folds.	Average vessels between folds.	Grooves in stomach wall.	Lobes, anus.	Gonad lobes. R.	Gonad lobes. L.
1	3292	Bering Sea	32	9	6	15	Smooth	28	11	11	R. 27-3-25-3-25-4-34-3-27-4-24-3-24-3-19-1-19-1-13-1-10-0 End.	273+	22.3	2.1	4	Three-fourths of margin finely lobed.	9-10	11
[2] 2	2057	St. Georges Shoal off Cape Cod.	...	8	5	23	Fine spines on much of surface.	19	10	9	R. 31-3-26-2-34-6-34-6-31-6-27-5-27-5 18-6-13-6-7-3. L. 4-43-4-27-3-32-6-31-8-28-6-23-5-19 5-13-5-9-3.	296 275	24.9	4.6+	4	.....do	7	?
3	2057	.....do	86	7	?	18	Fine spines nearly whole surfaces.	30	11	10	R. 3-26-7-22-4-26-9-33-10-21-14-12-6-16-5-12-3-6-4-7-3-3-2 L. 3-35-5-23-7-27-8-25-8-21-5-17-5-13 4-8-3-5-1.	265 256	16.7+	5.3+	?	.....do	?	?
[3] 4	Wm. Stimpson. U. S. Mus. No. 3206.	Chelsea Beach, Mass. Bay.	...	7	?	12	Rough	15	11	10	R. 28-?-21-?-27-?-33-5-28-5-23-2-28-4 19-8-12-7-7-6-5-2. L. 27-5-24-10-24-5-31-7-26-8-25-10-20 7-16-5-15-2-14.	270 291	21.6−	4.9	?	Broad, low, irregular.	?	6
5	3298	Bering Sea	20	6.5	3.5	20	Smooth	24	9	9	20-?-19-?-23-?-16-?-21-?-18-?-18-?-15-?-8-?	158	17.6−	?	4	Three-fourths of margin lobed.	7	6
6	3524	.....do	36	6	3.3	....	.....do	17	10	10	R. 28-0-18-0-27-0-31-0-26-3-22-4-18-2 16-2-13-2-6-1. L. 31-0-19-0-28-0-27-4-22-3-22-0-16-4 11-3-9-3-5-0.	213 207	19 7	1.4+	....	....	.....	.....
7	3238	.....do	18	6	3	12	Tubercles, spines?	18	9	9	23-2-16-?-22-?-29-?-26-?-22-?-19-1-14 2-9-2.	187	20.0	.7	4	Three-fourths of margin finely lobed.	7	6
8	U. S. F. C. 1872, Cat. No. 2674.	Eastport	....	6	3	?	Covered with fine spines.	13	9	9	R. 24-0-23-3-24-3-31-4-26-3-27-4-23-3 14-4-11-5. L. 23-3-15-5-28-5-21-6-18-4-20-3-15-3 13-3-5-2.	248 193	20.1−	3.2	3 or 4	.....do	7	?
9	L. Stejneger.	Kamchatka	36	6	3	14	Smooth	18	10	10	L. 24-0-24-0-30-2-34-0-33-0-34-?-?-?-10-1-9-1.	202+	24.8	.5	4	.....do	7	6
10	3266	Bering Sea	....	5.5	3	10.5	Tubercles and few spines.	18	9	9	R. ?24-0-19-1-33-3-22-3-20-3-16-1-15-1-11-1-7-3. L. ?..................................	173	17.4+	1.6	3	Two-thirds of margin lobed.	Lobes smaller.	
11	3553	.....do	57	5.5	2.25	19	.....do	18	9	9	25-2-20-1-22-2-27-2-24-2-24-0-20-2-13 3-10-4.	203	20.6	1.8	4	.....do	7	6
12	3276	.....do	18	5.25	3	20.5	Small tubercles, no spines.?	19	9	9	30-0-21-1-21-4-29-3-24-4-15-2-15-1-11 2-9-4.	174	19.3	2.2	4	.....do	7	6
13	3553?	.....do	51	5.5	2.25	....	Tubercles and spines.	18	9	9	25-2-20-1-22-2-27-2-24-3-24-0-20-2-13 3-10-4.	203	20.3	1.8	....	....	.....	.....

14	3556........	.....do........	20	4.3	2.5	....	Spines very short.	18	9	9	R. *28-1-17-1-24-2-23-4-18-2-12-3-9-2-?-?* L. *21-2-17-?-19-2-22-4-17-3-17-4-14-3 12-3-8-1.*	155+ 169	16.8+	1.9+	....	....	....	....
15	3303........	.....do........	33	3.5	2	7	Tubercles and spines.	19	10	10	*11-0-13-2-14-2-15-2-12-2-16-0-14-0-10 0-10-3-?-0.*	125+	12.8	1.0	2+	Two-thirds of margin lobed.	7	Small.
16	3278........	.....do........	68	3.5	2	8.5	Fine tubercles, no spines.?	15	10	10	*17-0-14-1-15-3-20-3-18-1-19-0-16-0-18-0-8-2-3.*	152	14.2	.9	4	.....do........	7	6
[4] 17	....	Eastport, Me..	....	3.5	1.5	23	Few spines....	15	9	9	*23-3-16-3-22-3-26-2-21-3-14-4-15-3-15-3-11-2.*	189	18.1	2.6	4	.....do........	7	6
18	3495........	East Bering Sea.	27	3	1.8	12	Tubercles and spines.	22	10	10	R. *16-?-14-?-20-?-22-?-18-?-20-?-17-?-17-?-13-?-3.* L. *25-?-16-?-21-?-20-?-22-?-17-?-15-? 11-?-9-?-4.*	165 150	16.25	.0	4	.....do........	10	10
19	3561........	Bering Sea....	66	1.5	3	....	Spiny.........	22	9	9	R. *16-0-13-0-17-0-23-0-22-0-19-0-15-0 12-0-10.* L. *23-0-17-0-18-0-23-0-21-2-16-1-12-1 8-1-5-1.*	148 150	16.1+	.4	....	....	....	....
20	3510........	.....do........	27	1.2	.9	....	.....do........	20	9	9	R. *9-0-8-1-10-1-12-1-13-0-11-0-10-0-5 0-1-0.* L. *13-1-10-1-13-2-13-2-13-0-9-0-6-2-3-0.*	82 90	8.9+	.55	....	....	....	....
[3] 21	U. S. F. C. Cat. No. 3156.	Eastport, Me..	....	2	.9	4	.....do........	13	?	?	R. *13-1-7-1-13-?-17-3-13*.............. L. *17-1-7-?-15*.......................	89	13 –	1.4	?	?	?	?
22	3274........	Bering Sea....	19	1.0	1.2	4	.....do........	17	9	10	R. *14-1-8-0-14-1-19-0-16-0-13-0-12-0-9-0-5-0.* L. *22-0-13-0-16-0-16-0-?-?-?-?-5-2-6 1-6-1-5-1.*	112 104+	11.7	.4–	4	Three-fourths of margin lobed.	7	5
[3] 23	U. S. F. C. Cat. No. 3156.	Eastport, Me..	....	1.0	.7	1	Spines long over whole surface.	19	9	?	R. *1-10-2-5-1-10-2-12-2-14-1-10-2-6-1 5-1-3-1.*	89	8.3	1.4	4	?	?	?
24	....	Bay of Fundy.	....	.9	.5	2.5	Spines fine and short over surface.	15	7	7	R. *9-1-5-1-9-1-12-0-11-0-?-0-9*......... L. *15-1-7-1-12-1-11-1-10-1-8-1-?*......	58+ 69+	9.8–	.7	Present..	Two-thirds of margin lobed.	?	?
25	3281........	Bering Sea....	36	.6	.4	....	....	14	7	7	R. *7-0-3-0-6-1-10-1-7-0-11-1-4-1*...... L. *10-0-4-0-9-0-10-0-6-0-5-1-3-1*......	52 49	6.8–	.4–	....	....	....	....
26	3553........	.....do........	57	.9	.7	....	Spiny.........	18	7	7	R. *11-0-8-0-12-0-14-0-13-0-12-1-8-4*... L. *13-0-6-0-10-1-15-1-11-1-9-1-7-2*....	83 77	10.6–	.7–	4	?	?	?

[1] Except where otherwise specified the numbers in this column are *Albatross* stations.
[2] Name previously applied, *B. bolteni.*
[3] Name previously applied, *B. rubra.* Cotype.
[4] Name previously applied, *B. clavata.*

Several points of considerable interest are brought out by the table. The one of perhaps most importance is that the surface of the test of young individuals is beset with spines. This is the character relied upon chiefly by Hartmeyer for the specific distinctness of *B. thomsoni*. An examination of a large number of small specimens forming a closely graded series of sizes leaves no room for question that the spininess is a juvenile mark—at least if small size can be relied upon as indicating youth.

The table also makes it obvious that the tentacles, the branchial folds and the internal longitudinal vessels increase in number with increase in size of the animal for a considerable period. The variation in tentacle number from 28 in the largest individual to 14 in the smallest is quite decisive on the point in spite of the fact that there are some notable departures from exact correspondence between body size and tentacle number.

The increase in number of vessels with size is even more positive though the correlation is not very close.

Another point clearly established by our dissections is that the extent of in-turning of the horns of the hypophysis mouth increases with the size of the animal.

It appears from the work done by the *Albatross* that *Boltenia ovifera* is abundant in the eastern and central parts of Bering Sea. According to Townsend (1900) the vessel has dredged at 225 stations in Bering Sea. At 29, or nearly 13 per cent, of these she took *Boltenia*. However, in some localities, particularly in Bristol Bay and about the Pribilof Islands, a majority of the hauls brought specimens. None at all were taken in the western or northern portion of the sea, but one specimen was collected in the south side of Ikaten Bay, Alaska, July 21, 1894. The collection contains one bottle of specimens from Kamschatka taken by Dr. Leonard Stejneger in 1882–83. There is also a bottle from Nunivak, Alaska, by Dr. W. H. Dall; one specimen from the coal station near Cape Lisburne, by Henry D. Woolfe, Sept., 1885, found on the beach after a northwest gale of four days; one specimen from Cape Smyth, John Murdoch, Point Barrow Expedition, Aug. 15, 1881; and one taken by the United States revenue steamer *Corwin* in 1885, exact locality not given.

The species appears to be rather narrowly limited in depth range in these waters, the shallowest record being 13.5 fathoms and the deepest 56 fathoms.

A sandy bottom seems to be distinctly preferred.

In view of the large number of specimens and the fact that they are nearly all not only from Bering Sea, but from a limited portion of it, I have departed from the usual course of giving locality data and have given merely a list of the *Albatross* stations with the depth of water.

The following is a list of *Albatross* stations in Bering Sea at which *Boltenia ovifera* was obtained: Station 3303, 33 fathoms; 3300, 15 fathoms; 3495, 56 fathoms; 3496, 41 fathoms; 3556, 49 fathoms; 3553, 51 fathoms; 3561, 48 fathoms; 3536, 40 fathoms; 3524, 36 fathoms; 3511, 39 fathoms; 3510, 27 fathoms; 3505, 44 fathoms; 3504, 34 fathoms; 3298, 20 fathoms; 3297, 26 fathoms; 3296, 24 fathoms; 3294, 30 fathoms; 3293, 30 fathoms; 3292, 32 fathoms; 3291, 26 fathoms; 3282, 53 fathoms; 3281, 36 fathoms; 3286, 37 fathoms; 3278, 47 fathoms; 3276, 18 fathoms; 3274, 19 fathoms; 3266, 24 fathoms; 3249, 13.5 fathoms; 3238, 18 fathoms.

HARTMEYERIA, new genius.

Plate 33, figs. 8–13.

Agreeing generally with *Microcosmus*, but:

1. Body with a slender, rather long peduncle.
2. Atrial tentacles, and a periatrial band quite similar to the peripharyngeal band present.

Type-species.—Hartmeyeria triangularis, new species.

HARTMEYERIA TRIANGULARIS, new species.

Superficial characteristics.—Body inclined to a triangular form, the two orifices marking the basal angles, and the peduncle the third angle; somewhat compressed laterally; the whole surface, excepting the siphons, covered with a layer of black, closely adhering sand grains. Test on the rather prominent siphons usually presenting a series of regular, parallel, closely set ridges or folds, these with the light color of the test in this region as opposed to the covering of black sand, setting the siphons off conspicuously from the rest of the body. Greatest diameter of largest specimen, 14 mm. Length of longest peduncle seen, 35 mm. Thickness of peduncle uniform and scarcely more than 1 mm. in the thickest part, possessing a well-defined coating of test to which the sand adheres as it does on the body. Surface of test beset with fine short processes to which the sand grains are attached; test itself thin and leathery. Mantle thin, musculature sparse, but very regularly spaced (pl. 33, fig. 9), circular bands more numerous than the radial, extending over the whole body—not limited to the siphonal regions. Circular bands external to the radial bands except on a portion of each siphon where they are internal to the radials.

Respiratory system.—Siphons rather prominent and distant from each other, distinctly 4-lobed. Tentacles, branchial, 20 to 35, of different sizes, branched knobs, quite irregular in arrangement. Hypophysis mouth horseshoe-shaped, the horns nearly touching each other, making the whole almost a circle. Peripharyngeal band unusually broad; an epithelial fold, *p.g'*. (pl. 33, fig. 11) or velum within the peripharyngeal field some distance from the inner lip of the peribranchial band, *p. g.*, and further toward the branchial orifice still another ridge, or fold, less prominent than the last, *e. f.* In all, consequently, four epithelial ridges encircling the branchial orifice, two (those of the peribranchial band proper) external to the tentacle circlet; and two within the circlet, *e. f.* and *e. f'*. Dorsal lamina a plain narrow ridge, with intimations of ribbing in some specimens. Branchial membrane, 6 folds (counting rudiments) on each side. The typical number of longitudinal vessels on the folds as follows:

$$\text{Endostyle}\begin{cases} 1\text{–}\mathit{6}\text{–}0\text{–}\mathit{7}\text{–}0\text{–}\mathit{9}\text{–}1\text{–}\mathit{11}\ \text{L.} \\ 0\text{–}\mathit{4}\text{–}0\text{–}\mathit{6}\text{–}0\text{–}\mathit{9}\text{–}0\text{–}\mathit{9}\text{–}1\text{–}\mathit{11}\ \text{R.} \end{cases}$$

From this it appears that the second and sixth folds on the left, and the second on the right are marked by a single longitudinal vessel. There are no vessels between the folds. This scheme, with slight variations, holds for the four specimens examined. Stigmata nearly straight, but irregular in length, from 14 to 20 in the mesh; about six prominent transverse folds or ridges on the outer surface of the sac; a series of large transverse vessels on the inner surface of the sac separating generally the series of stigmata, and a large number of fine vessels extending across the stigmata (fig. 13). Ganglion long and narrow, its anterior end adjacent to the hypophysis. Atrial tentacles very long in proportion to thickness, about 16 in number forming a circlet around the atrial orifice; within the circlet and close to the bases of the tentacles a ciliated epithelial fold which may be called a periatrial fold, *p. a. f.* (fig. 12).

In close association with the atrial tentacles numerous tubercles produced by parasites (suctoria), embedded in the epithelial lining cf the region (fig. 12).

Alimentary system.—On the left side of body, loop simple but narrow; stomach not distinctly differentiated from intestine, two folds in stomach wall; "liver" well developed, consisting of a great number of more or less independent alveoli (fig. 10). Renal organ present (?) on right side near base of branchial sac.

Reproductive system.—On both sides of body, that of the left crossing the dorsal limb of the intestinal loop, more or less cylindrical, surrounded by the more voluminous many-lobed testes (fig. 10, *gon.*). A few structures, resembling the so-called endocarps of *Styela* and its allies present.

This unique species possesses a combination of characters that suggests relationships in various directions. The long, slender peduncle reminds one of the genus *Rhizomolgula*, and also of some of the Boltenias, and of *Culeolus*. With this feature, however, resemblance to these genera ends. On the whole the animal would seem to approach *Microcosmus* more closely than any known genus. Sluiter (1900, p. 31) has described a member of this genus, *M. minia-*

ceus, as having a short peduncle. However, the structure in this case is thick, and is accompanied by other root-like processes. Sluiter does not go into details as to the structure of these parts, but his description and figure would seem to indicate that they are quite different from the peduncle of *H. triangularis*.

Atrial tentacles are now known to occur in several quite widely separated groups of ascidians, so that this feature alone would probably not justify a new genus for the species. However, when taken in connection with the peduncle and the unusual supply of epithelial bands around the orifices, it would seem that to assign the species to any known genus would be forcing matters somewhat more than giving it a genus by itself.

An additional structural point in connection with the atrial tentacles may be mentioned. As is shown in figure 12, the attachment of each tentacle is some distance from the periatrial band. However, a minute strand, seemingly epithelial, extends from the root of the tentacle to the band. These strands would seem to be rudimentary and adherent portions of the tentacles.

I have mentioned the epithelial knobs on the inner surface of the periatrial field in the diagnosis on account of the possibility that they may be normal growths into which the parasites enter instead of products of the parasitic action.

Type-locality.—About two dozen specimens taken by Dr. W. H. Dall in 9 to 12 fathoms at Kyska Harbor, Aleutian Islands, Alaska.

Type.—Cat. No. 5679, U.S.N.M.

CULEOLUS SLUITERI, new species.

Plate 34, figs. 14–17.

Superficial characteristics.—Body irregularly conical, the base of the cone (posterior end of animal) not flat but sharply arched; only slightly, if at all, compressed, peduncle attached to apex of cone, the transition from body to peduncle being much the same all around (pl. 34, fig. 14). Branchial orifice at the summit of a broad, low mound situated about one-third of the distance between the insertion of the peduncle proper and the atrial orifice. The opening large, irregularly triangular, the base of the triangle directed forward and constituting an arched lip, smooth, except for a number of fine creases; border of the posterior apical part of the opening irregularly puckered and lobed. Atrial orifice a large transverse slit broadly notched in the middle of the anterior lip, situated far back on the dorsal side of the body. Entire surface covered with low, broad mounds, each of which bears at its summit a wartlike brownish knob, the knobs extending, gradually reduced in size, on to the apex of the body to the point at which the body is lost and the peduncle begins; also a few scattered small warts on the peduncle. Color a dull white, uniform except for the scattered brownish warts above mentioned. Minute green-black sand grains evenly sprinkled over the entire surface. Greatest length of body, 6.5 cm.; diameter, 4 cm.; peduncle, 11 cm. long, about 3 mm. thick in the thinnest part, expanded to about 4 mm. at the end remote from the body. No holdfast present, indicating that a portion has been broken off. Test halfway between leathery and gelatinous in consistency, hardly more than 1 mm. thick, except in the mounds on the surface mentioned above; almost chalk white on the inner surface, the brown warts showing through in color, and each marked by a slight prominence. Mantle thin, semitransparent, somewhat resembling thin, crumpled parchment paper; muscles sparse, the encircling fibers disposed in very definite bands, these separated by wide regular intervals, and of nearly equal abundance throughout; longitudinal fibers present but disposed in less well-defined bundles; a few bundles of the type of the encircling bundles running diagonally. Little or no concentration of muscle fibers about the orifices.

Respiratory system.—At least 33 tentacles varying in size from almost minute with few small branches to large with many branches bearing numerous secondary branches (fig. 15). Branchial membrane with five prominent folds on each side, the scheme of longitudinal vessels as follows:

$$\text{Endostyle}\begin{cases}1–\mathit{8}–1–\mathit{8}–1–\mathit{14}–1–\mathit{9}–2–\mathit{13}–1\\ 1–\mathit{5}–2–\mathit{11}–1–\mathit{15}–1–\mathit{5}–1–\mathit{10}–1\end{cases}$$

As usual in *Culeolus* no true stigmata present, the membrane consisting entirely of the wide-meshed network of longitudinal and transverse vessels; transverse vessels of two or three sizes alternating more or less regularly, some of them, particularly the smaller ones, frequently interrupted. A dorsal languet for each transverse vessel. No spicules in any of the tissues of the branchial apparatus.

Alimentary system.—(In too advanced a state of disintegration for full characterization.) On left side, forming a wide evenly curved U; stomach apparently but little greater in diameter than intestine; bearing a number of lobes (liver?); rim of anus lobulated all around.

Reproductive system.—On both sides, those of the left within the intestinal loop (fig. 17), both ovary and testes clinging to the mantle. Ovaries elongated, sausage-shaped, one on each side of body (figs. 16, 17), surrounded by the testis masses, but easily separating from these and from the mantle; testes, a single series of eight large and several small widely separated masses on the left, and three series on the right, one with eight masses, one with seven masses, and one with six. The irregularly lobulated masses of each side all connected with a sperm duct closely adherent to the mantle.

The relation of the parts of the genital system to one another in this species is obscure. The statements about the male and female gonads given in the diagnosis will almost certainly have to be modified when fuller knowledge is obtained. The masses called testes in the text and figures contain ova as well as sperm, and since these are both small and large they are obviously produced here. In other words the gonads are hermaphroditic in the sense in which this condition prevails with many ascidians. So far no unusual difficulty appears. The puzzle is as to the nature of the cylindrical body called ovary in the description. This contains ova in most of its length, these being in part large, apparently ripe, and in part small and immature. They cling to the inner wall of the canal forming a definite layer thereon, but show no true ovarian arrangement. The exact relation of these to the gonad lobes can not be made out owing to rupture and disarrangement of the parts. From what can be observed the cylinders would seem to be receptacles which receive the ova from the ovaries while still immature, and in which they ripen.

In external appearance this species considerably resembles *C. wyville-thomsoni* Herdman, though the body of *sluiteri* is somewhat longer proportionately and is more regular, the prominences on the test being here somewhat smaller and uniformly distributed. Perhaps the most distinctive feature about *sluiteri* is the small number, 5, of branchial folds, 6 being the prevailing number in the genus, though one species, *C. gigas* Sluiter has 7 folds. But it should be stated that intimations of folds occur at several places between the large, well-defined folds in *C. sluiteri*. Another feature, the absence of spicules from the tissues of the internal organs, would be, should it prove on further study to be true for all individuals and in all conditions of life, the most considerable differential mark of the species, and might even be considered sufficiently important to entitle *sluiteri* to be taken as the type of a distinct genus. Until, however, more specimens have been examined, and until we know more than we now do about the physiological significance of mineral deposits in the tissues of ascidians, I do not believe it is wise to place great emphasis on their value in classification. It is possible, too, that the much elongated ovaries and the sharp separateness of these from the testes may some time serve as characters of generic rank.

I am glad to name this well-marked, interesting species after Doctor Sluiter who has added so materially to our knowledge of the genus.

Type-locality.—A single specimen. *Albatross* station 3480, lat. 52° 06′ N.; long. 171° 45′ (just south of Aleutian Islands), 283 fathoms, bottom bk. s. co. rky., July 8, 1893.

Type.—Cat. No. 5688, U.S.N.M.

STYELA MACRENTERON, new species.

Plate 34, Figs. 18–20.

Superficial characters.—Large, specimens from 50 to 90 mm. in length not uncommon, in general cylindric in form, the length from two to three times the diameter. Usually attached by the whole posterior end and rising column-like. Smaller specimens more nearly spherical, often in clusters, though less closely crowded than some of the related species. Orifices at the anterior end usually separated by a wart-like or spine-like tubercle, the four distinct lobes rather small; *siphons* not high in the preserved specimens, but frequently rather tumid and conspicuous indicating that in life they may be of good length; branchial frequently bent over so that its orifice is directed ventralwards. Test thin and parchment-like, rather easily torn smooth on the inner surface, but the outer surface presenting a great number of nearly parallel circular ridges, sharply defined, and giving the animal a very characteristic appearance; these ridges more positively developed in older specimens. In addition to the ridges the surface of the test bearing short, thick, somewhat fleshy processes, in some specimens and in some areas of the surface these being so close together as to give the appearance of the plush of velvet. Occasional areas entirely devoid of either ridges or processes the test then being left smooth and glistening. Barnacles, hydroids, other ascidians, etc., frequently clinging to the surface. Color light gray, frequently obscured, especially in the grooves between the ridges, by dirt and other foreign substances. Mantle strong from the heavy uniform layer of external longitudinal muscle fibers and the somewhat less strong internal circular layer.

Respiratory system.—*Branchial tentacles* varying from 40 to 65, in a single circle, rather stout and crowded, of different lengths. Dorsal tubercle prominent, the hypophysis mouth horseshoe-shaped, the ends approaching each other closely and rolled in. Dorsal lamina entire. Branchial membrane with four folds on each side, these not high in proportion to the size of the sac as a whole; longitudinal vessels on the folds crowded, from 10 or 11 to 22, occasionally more (compare table), from 6 to 12 vessels between the folds; these not crowded. From 4 to 9 stigmata to the mesh.

Alimentary system.—On the left side, stomach very long and relatively narrow, bent almost at a right angle near its esophageal end, its posterior two-thirds or three-fourths standing nearly erect and reaching from the very base of the body to above its middle, it being thus more than half the length of the animal. The stomach wall with from 25 to 50 prominent internal longitudinal folds, these being visible on the external view of the organ. Intestine remarkable for its great length and its convolutions (figs. 19, 20), these latter being at least two in number, the coils again often increased in length by their tortuous course. The intestinal coil packed between the concavity of the upright stomach and the dorsal edge of the body. A distinct, smaller, lighter colored rectal piece of intestine present with a portion of its wall furrowed lengthwise by numerous regular plications; the anus bordered by from 12 to 15 or more prominent rounded lobes.

Reproductive system.—One long sausage-like ovary on each side, with many testis lobes clustered around these, the ovarian cylinders extending diagonally lengthwise of the animal, sometimes bent, in a few individuals to a distinct V-shape. *Endocarps* present, but not abundant nor large.

TABLE 10.

No. of specimen.	*Albatross* stations.	Locality.	Depth in fathoms.	Size in mm.	Horn.	Tentacles.	Folds on sac.	Longitudinal vessels in sac.	Total vessels.	Average vessels on folds.	Average vessels between folds.	Stigmata in mesh.	Stomach folds.	Anal lobes.	Loops of intestine.
1	Summer, 1890.	Bering Sea	?	85 by 35.	Present	50	4	L. 4-14-5-16-5-22-5-26-7 R. 3-16-7-14-?-15-7-22-5 D. L.	104 89	19.5 16.75	5.25 5.5	6	25	15	2
2	?	Alaska	?	78 by 30.	Absent	54	4	L. 4- 8-9-12- 8-17- 8-22-8 R. 4-10-9-14-10-11-13-21-10 D. L.	94 102	15 14	7.4 8.25	6-9	35	15	2
3	3254	Bering Sea	46	90 by 30.	Obscure	49	4	L. 3-12-8-17-9-16-12-22-6 R. 4-12-9-17-9-14- 9-22-7 D. L.	105 103	16.75 16.25	7.4 7.6	6-10	About 43	15	2
4	3279	do	41	60 by 33.	do	44	4	L. 4-11-7-14-7-13-9-18-6 R. 4-12-8-13-8-12-7-14-9 D. L.	89 91	14 12.75	6.6 7.2	6-9	43	17	2
5	3523	do	39	60 by 35.	Present	60	4	L. 4-12- 9-17-7-15-10-24-3 R. 5-11-11-13-9-15- 9-26-4 D. L.	91 103	17 16.5	6.6 7.6	6-8	40	15	2
6	3305	do	44	55 by 30.	do	65	4	L. 3-12-6-13-9-11-8-21-3 R. 4-13-9-11-5-15-9-16-6 D. L.	86 88	16.25 13.75	5.8 6.6	7	50	?	2
7	3253	do	36	55 by 25.	do	54	4	L. 4-11-8-13-6-11-8-18-4. R. 6-12-11-13-9-13-8-20-4 D. L.	83 96	13.25 14.5	6 7.6	?	?	?	2
8	3512	do	38	50 by 25.	do	?	4	5-16-7-19-8-18-7-21-? D. L.	101	18.5	6.75	4-6	?	12	2
9	3292	do	32	55 by ?	Obscure	52	4	L. 4-10-8-16-10-13-12-18-8 R. 5-13-9-15-10-11-12-16-7 D. L.	99 96	16.25 13.5	8.5 8.6	5-7	40	17	2 small
10	3282	do	53	45 by 35.	Absent	65	4	L. 4-10-8-14- 9-15-11-24-6 R. 3-12-9-12-10-12-10-21-8 D. L.	101 97	15.75 14.25	7.6 8	6-7	36	17	2
11	3506	do	36	40 by 30.	Obscure	46	4	L. 4- 9-7-13-9-19- 7-19-5 R. 4-11-9-15-7-14-11-16-8 D. L.	92 95	15 14	6.5 7.8	?	39	?	2
12	3642	do	16	35 by 25.	do	40	4	L. 3-8-4-14-5-8-5-20-3 R. 3-7-5-10-5-9-6-13-7 D. L.	70 65	12.5 9.75	4 5.25	6-9	42	Lobed.	2
13	3513	do	35	30 by 23.	Present	54	4	L. 5-9-7-14-6-14-7-22-5 R. 3-6-6-13-6- 9-7-17-8 D. L.	91 75	14.75 11.25	6 6	4-7	40	15-20	2
14	3303	do	33	30 by 20.	do	40	4	L. 2-12-2-10-3-7-?-16-4 R. 3-10-3- 8-4-9-4-13-5 D. L.	56 59	11.25 10	3.75 3.8	5-6	40	17	2
15[1]	3317	do	165	27 by 17.	Prominent	26	4	L. R.		18-19	7	?	34	Very large.	1 ?
16	3553	do	51	20 by 17.	do	54	4	L. 3- 9-6-10-5- 9-4-23-5 R. 4-11-7-14-7-12-9-14-6 D. L.	74 84	12.75 12.75	4.6 6.6	6	?	15	2
17	3303	do	33	18 by 16.	?	?	4	2-15-2-12-2-16-3	52	14.3	2.25	6-8	40	?	2

[1] Identification doubtful.

In the length and voluminousness of the digestive canal this species is entirely unique among ascidians, so far as I know. In a specimen 80 mm. long the intestine, including the stomach, was 187 mm. long, or one and a third times the length of the animal. The intestine, exclusive of the stomach, was 142 mm. long in this individual. The gut of a dissected animal resembles that of a mouse quite as much as it does that of an ordinary ascidian.

So far as I have been able to determine the canal of *Styela nordenskjöldi* Michaelsen, 1900, from the region of Cape Horn, approaches that of this species more closely than any other. However, there is no such elaborate coiling of the organ in the South American species as in *S. macrenteron*, and there is little in common between the two species in other respects.

Many of the individuals possess a stout, hard, sometimes quite regularly pyramidal spike or horn between the siphons (fig. 18). In this the species strongly resembles a *Styela* that has been known as *S. monoceros* because of this structure. There is, however, no possibility of identifying the animals before us with the *S. monoceros* of the north European seas. Herdman (1893), who considers *monoceros* to be a good species, has described and figured the animal, and the simplicity of the intestine as shown by him would of itself be nearly conclusive as to the specific distinctness of the two creatures. But as a matter of fact they differ to some extent in almost every respect, *macrenteron* being somewhat larger in size and more cylindric in form; having a larger number of tentacles, more internal vessels on the branchial sac, both on the folds and between them; more stigmata between the vessels, and, seemingly, a larger number of folds in the stomach wall. Hartmeyer, 1899 and 1903, has returned to the older view that *monoceros* is only a form of *S. rustica*, there occurring, according to him, horned individuals of *rustica* which are indistinguishable, specifically, in any other way from hornless animals.

Not having had an opportunity to study the subject first hand in any critical way, I would not presume to pass upon the question of the specific distinctness of *monoceros*. At the same time it is worth while to point out that the presence of a horn very similar indeed to that present in *monoceros*, in most, though not in all, individuals of another very distinct species, shows the somewhat sporadic character of the structure, and so indicates its unreliability as a species mark. And it should be noted further that in most individuals of *S. macrenteron* there is a marked tendency to a tuberculation of the test around and between the siphons, even when the horn proper is doubtfully present, thus suggesting that the horn should be looked upon as one of the test tubercles specially well developed in most but not in all individuals.

The following are the partial locality data of the collection:

Albatross 3279, 4 specimens, lat. 56° 25′ 40″ N.; long. 162° 39′ 15″ W., 41 fathoms, fne. gy. s., June 28, 1890.

Albatross 3512, 12 specimens, lat. 57° 49′ 30″ N.; long. 169° 27′ W., 38 fathoms, fne. s. gn. m., August 1, 1893.

Albatross 3553, 1 specimen, lat. 56° 28′ N.; long. 169° 46′ W., 51 fathoms, fne. gy. s. m., September 2, 1893.

Albatross 3506, 1 specimen, lat. 57° 33′ N.; long. 165° 55′ W., 36 fathoms, gy. s. m., July 29, 1893.

Albatross 3523, 16 specimens, lat. 57° 39′ N.; long. 170° 02′ W., 39 fathoms gn. m. fne. s., August 4, 1893.

Albatross 3303, 3 specimens, lat. 57° 27′ N.; long. 160° 23′ 30″ W., 33 fathoms, bk. s., July 21, 1890.

Albatross 3305, 1 specimen, lat. 57° 51′ 30″ N.; long. 161° 40′ W., 23 fathoms, fne. gy. s., July 22, 1890.

Albatross 3282, 1 specimen, lat. 56° 30′ 45″ N.; long. 161° 50′ 15″ W., 53 fathoms, fne. s. gn. m., June 29, 1890.

Albatross 3642, 1 specimen, lat. 52° 57′ 45″ N.; long. 158° 36′ 30″ E., 16 fathoms, bk. m., August 19, 1896. (This station is in Avatcha Bay, Kamchatka.)

Albatross 3253, 2 specimens, lat. 57° 05′ 50″ N.; long. 164° 27′ 15″ W., 36 fathoms, m. s., June 14, 1890.

Albatross 3254, 8 specimens, lat. 56° 50′ N.; long. 164° 27′ 50″ W., 46 fathoms, gn. m. s., June 14, 1890.

Albatross 3505, 12 specimens, lat. 57° 09′ N.; long. 168° 17′ W., 44 fathoms, fne. gy. s., July 28, 1893 (type locality).

Albatross 3511, 10 specimens, lat. 57° 32′ N.; long. 169° 38′ W., 39 fathoms, fne. s. dk. m., August 1, 1893.

Albatross 3536, 4 specimens, lat. 57° 05′ N.; long. 170° 35′ W., 40 fathoms, gn. m. fne. s., August 8, 1893.

Albatross 3513, 9 specimens, lat. 58° 27′ N.; long. 169° 01′ W., 35 fathoms, fne. s. gn. m., August 1, 1893.

Albatross 3522, 16 specimens, lat. 57° 58′ N.; long. 170° 09′ W., 41 fathoms, crs. gy. s. g., August 4, 1893.

Albatross 3638, 1 specimen, lat. 57° 07′ 30″ N.; long. 170° 28′ 15″ W., 33 fathoms, g., July 18, 1896.

Albatross 3292, 1 specimen, lat. 57° 14′ N.; long. 159° 35′ W., 32 fathoms, bk. s. g., July 18, 1890.

Albatross 3317, 1 specimen, lat. 53° 57′ 40″ N.; long. 166° 59′ W., 165 fathoms, crs. s. g. r., August 16, 1890.

Albatross, "Summer 1890," dozen specimens (probably Bering Sea). 1 specimen, lat. 62° 15′ N.; long. 167° 48′ W., 20.5 fathoms, Lieut. George M. Stoney, U. S. Navy, June, 1884.

U. S. S. *Corwin*, "Explorations in Alaska, 1884," 6 specimens (from U. S. Museum records these explorations are known to have been "in the vicinity of Bering Strait").

"No label," 12 specimens.

All these stations so far as known, and probably all, are in Bering Sea.

In giving the number of individuals I have ignored a great many little ones sitting on the large ones.

Type.—Cat No. 5686, U.S.N.M.

STYELA HEMICÆSPITOSA, new species.

Plate 34, figs. 21–23.

Superficial characters.—Posterior half or less of body covered by a dense mat composed of short, filiform, more or less intertwined processes growing on the test, this carrying embedded among and clinging to the processes a quantity of fine greenish earth. Anterior half or more wholly devoid of the processes, the test here varying from nearly smooth in the flat form to pronouncedly tuberculate, particularly around the orifices in the pyramidal form; the tubercles generally somewhat soft and blister-like, often low and flat and separated from one another by considerable intervals. Form varying from flat-elliptical to high conical or cylindrical. Large specimens of the flat form 20 mm. in greatest transverse diameter and 12 mm. in height; large specimens of pyramidal form 12 mm. in greatest transverse diameter, and 15 mm. in height (figs. 21, 22). Siphons absent or very short, near together; orifices inconspicuously four-lobed. Test thin, rather stiff, opaque white where free from discoloration by the mud in which the animals lived. Mantle thin and delicate, the constituent muscle bundles being very fine and close together; musculature of nearly equal development over the whole body.

Respiratory system.—Branchial tentacles varying in number from 25 to 40, several sizes, the largest long and strong, laterally compressed, the smallest hardly more than short flattened stubs. Atrial tentacles present in great numbers, more than 100, very fine filiform, all of nearly equal length. Dorsal tubercle spherical, projecting prominently; hypophysis mouth broad U-shape, ends little or not at all curved, directed forward. Branchial sac with four folds on each side, all low, with wide intervals between them. (For the scheme of longitudinal vessels of sac see Table 11.) Transverse vessels of two sizes, regularly alternating, the smaller ones usually crossing the stigmata. Stigmata long and open with parallel borders, from 4 to 6 between two longitudinal vessels in the spaces between the branchial folds. Branchial network generally regular in its elements, as described. Dorsal lamina neither toothed on the edge nor ribbed on the side. Endostyle not prominent, tortuous at the anterior end.

TABLE 11.

No. of specimen.	*Albatross* Station.	Locality.	Depth in fathoms.	Size in mm.	Test.	Tentacles.	Folds on sac.	Longitudinal vessels in sac.	Total vessels.	Average vessels on folds.	Average vessels between folds.	Stigmata in mesh.	Ovaries on each side.	Stomach folds.	Anal lobes.
1	3227	Bering Sea	225	High form, 20 by 18.	Upper nearly smooth, lower rough.	35	4	L. 4-5-6-11-5-10-6-14-2. R. 4-10-9-17-2-19-3-15-9 D. L.	63 90	10 15+	4.6 5.4	4	1	22	Lobe.
2	2971	Off Southern California.	29	High form, 20 by 10.	......	36	4	?-14-6-12-7-6-2-15-5 D. L.	62	14+	5	4-6	(?)		
3	2838	Off Lower California.	44	......do	Thin in middle, warty near siphons.	22+	4	L. 1-11-2-10-2-11-4-16-1 R. 1-12-1-15-2-12-2-17-2 D. L.	58 64	12 14	2.6 2	7	2	27	
4	2338?	......do	44	High form, 20 by 13.	Anterior smooth, posterior furry.	30	4	......	....	[1]20	4	5-8	1	30	
5	2972	Off Southern California.	61	Low form	......	37	4	L. 5-9-7-18-6-16-7-18-3 D. L.	89	15.25	5.6	4-6	1	(?)	6 lobes.
6	2972′	......do	61	Low form 13 by 25.	Thick and cartilaginous.	40	4	L. 2-8-7-10-5-8-6-16-4 R. 4-9-6-11-6-11-7-13-6 D. L.	66 73	10.5 11	5 6	7	2	22	Regular like beads.

[1] Maximum.

Alimentary system.—On the left side of the body the intestinal canal as a whole forming a reversed S as seen from the outer surface, the ventral or gastric portion of the S being considerably broader than the dorsal or rectal portion. Esophagus short; stomach spindle-shaped, about a third longer than thick, wall closely and deeply folded, the folds about 30 in number; intestine of quite uniform diameter throughout; anal border with a series of distinct, somewhat bead-like lobes, in some specimens these extending all the way around, while in others they are restricted to scarcely more than one-half of the circumference, the other portion being occupied by a single projecting pointed lobe or lip (fig. 23).

Reproductive system.—On both sides of the body. Ovary consisting of a much elongated, evenly cylindrical mass, two or one on each side, on the left crossing the rectal part of the intestinal loop, and in some individuals reaching back across the gastric portion of the loop also. Testes consisting of fully separated bodies of unequal size and irregular shape arranged along both sides of each ovarian cylinder, but sharply separated from it. Both ovaries and testes adhering closely to the mantle, the testes seeming to be without common sperm ducts, each lobe discharging its sperm independently (fig. 23).

The great individual variation among the animals strongly suggests at first sight that we are dealing with two quite distinct specific groups. The difference in shape, for example, as shown by the photographs, and as indicated in the diagnosis by the terms "flat form," and "pyramidal form" is striking indeed, and when taken in conjunction with other external differences, particularly the tuberculation of the test in the pyramidal form and the evenness of the surface in the flat form, would lead one to say without hesitation that the two styles make two well-separated species.

Such an internal difference, too, as the presence of two ovaries on each side in some individuals and of only one in others would, according to our usual notions about species in the genus *Styela*, strongly incline one to believe we have to do here with two species. The several differences do not, however, correlate with one another in such way as to make a specific grouping possible at least within the limits of the specimens examined. For example, some of the pyramidal forms possess double ovarian cylinders on both sides of the body while others have single cylinders on both sides, and the same variation occurs among the "flat" animals. Again, the differences in the number of longitudinal vessels of the branchial sac between the branchial folds are sufficient to serve as specific marks, as these structures usually go; but here a correlation between either the maximum or the minimum number of the vessels with the extreme of variation in other particulars is not obvious. I conclude, therefore, that no other course is open than to assign the specimens all to one species pending the time when dissections of a sufficiently large number can be made to test more thoroughly the question of correlation of the variations.

In the structure and disposition of the furriness of the test *S. hemicæspitosa* is, so far as I can determine, unique in the genus, it resembling more closely in this respect the *Polycarpa*, or *Pandocea fibrillata* of Alder and Hancock than any other ascidian.

The species considerably resembles, particularly in some of its variations, *S. milleri* Ritter and *S. sigma* Hartmeyer. From *milleri* it differs, not only in the extent and arrangement of the test fur, but in the smaller number of branchial tentacles, the smaller number of vessels on the branchial folds, and the smaller number of testis lobes. And *S. sigma* appears to be wholly devoid of the test fur, to be a much larger species, and to possess a greater number of vessels between the folds of the branchial sac. Furthermore, the gonads of *sigma*, seemingly two on each side in all cases, are, as I infer from Hartmeyer's description, hermaphroditic, and so lacking the separate testicular masses characteristic of *hemicæspitosa*. Hartmeyer does not mention the point in his text, but his figure shows only the two pairs of cylindrical bodies on each side; and in several other species which he says are rather similar to *sigma* the gonads are expressly stated to be hermaphroditic. But the species with which *hemicæspitosa* undoubtedly has most in common is *S. loveni* (Sars), some individuals of this species presenting an approach to the hairiness of the test so conspicuous in *S. hemicæspitosa*. And interestingly enough *loveni* runs through a range of shape variations, as shown by Hartmeyer and others, almost exactly parallel with that presented by our species. But the test hairiness is almost wholly wanting in most specimens of *loveni*. This difference between the two species may be correlated with their difference in habitat, *hemicæspitosa* being a dweller on muddy bottoms, while *loveni* is usually found closely adherent to stones, shells, etc. The two species seem to be well differentiated, too, in the character of the branchial sac, the folds in *loveni* being less prominent, and the whole membrane, both folds and interspaces, carrying fewer longitudinal vessels.

The distribution of the species is surprising. All the specimens except two are from the coast of southern and Lower California, and from depths not exceeding 61 fathoms. Two individuals are from Bering Sea, taken at a depth of 225 fathoms. The agreement between the northern and southern specimens is very close, the only difference, so far as I am able to see about which there may be a question, being in the testis lobes. These are somewhat more numerous and voluminous in the Alaskans.

Albatross 2838, lat. 28° 12′ N.; long. 115° 09′ W., off Lower California, 44 fathoms, bottom gn. m., May 5, 1888; about 20 specimens, all pyramidal form.

Albatross 2971, lat. 34° 20′ 30″ N.; long. 119° 37′ 50″ W., off southern California, 29 fathoms, bottom fne. gy. s. m., February 11, 1889; 1 specimen, pyramidal form.

Albatross 2972 (type-locality), practically same location as 2971; but 61 fathoms, bottom gn. m.; about 40 specimens, all but three or four of the "flat form."

Albatross 3227, lat. 54° 36′ 30″ N.; long 166° 54′ W., Bering Sea, 225 fathoms, bottom gn. m., May 23, 1890; 2 specimens, pyramidal form.

Type.—Cat. No. 5684, U. S. N. M.

STYELA SABULIFERA, new species.

Plate 34, figs. 24–26.

Superficial characters.—Very regular in outline and rigid in consistency, covered all over with a closely set layer of black sand grains. Orifices rather near together at the anterior end, without siphons and scarcely recognizable in the preserved specimens. Body distinctly longer than broad, antero-posteriorly, and considerably compressed or wedge-shaped, the posterior end being thinnest (pl. 34, fig. 24). Some specimens with a considerably elongated process near the posterior end. Surface of the rather thick test bearing many short processes longest along the posterior margin of the body. Mantle musculature strong, the outer layer of circular fibers stronger than the inner layer of radial fibers. Length of a full-sized individual 17 mm, width 14 mm, thickness about 10 mm.

Respiratory system.—Four lobes of the orifices clear cut, small, but rather distinct because of their whiteness. Branchial tentacles simple, 20 to 30, of different sizes (fig. 25 *b. t.*), the larger and smaller alternating more or less regularly. Hypophysis (*hy.*) with a simple circular or oval-shaped mouth. Branchial membrane with 4 folds on each side, longitudinal vessels (*i. l. v.*) on folds of two specimens as follows:

$$\text{No. 1. Endostyle}\begin{cases}0\text{–}\mathit{5}\text{–}0\text{–}\mathit{4}\text{–}0\text{–}\mathit{6}\text{–}0\text{–}\mathit{5}\ \text{L.}\\0\text{–}\mathit{3}\text{–}0\text{–}\mathit{5}\text{–}0\text{–}\mathit{3}\text{–}0\text{–}\mathit{13}\ \text{R.}\end{cases}$$

$$\text{No. 2. Endostyle}\begin{cases}0\text{–}\mathit{4}\text{–}0\text{–}\mathit{5}\text{–}0\text{–}\mathit{4}\text{–}0\text{–}\mathit{7}\ \text{L.}\\0\text{–}\mathit{5}\text{–}0\text{–}\mathit{6}\text{–}0\text{–}\mathit{4}\text{–}0\text{–}\mathit{13}\ \text{R.}\end{cases}$$

No vessels between the folds; stigmata straight, 12 to 20 in the meshes. Dorsal lamina entire (*d. l.*), that is, without marginal teeth or ribbings.

Alimentary system.—On the left side, first part of intestine doubling back into close contact with stomach, rectal portion extending forward parallel with and near to the dorsal edge of the body. Stomach long with about 22 distinct oblique folds; anus with many small marginal lobes.

Reproductive system.—Gonads very definitely sausage-shaped masses, about 6 on each side of the body, placed transversely, those of the left side situated in the dorsal intestinal loop. Testes and ovary closely associated in the same mass, but not hermaphroditically (fig. 26 *gon.*).

Many delicate endocarps projecting from the mantle in among the gonads.

This rather unique *Styela* seems to have more in common with *S. vestita* (Alder) than with any other member of the genus. The most striking feature is the gonads. Alder and Hancock (1907, p. 124) remark on the peculiarity of the gonads in *S. vestita,* which resemble considerably those of the present species, and state that "the only other species in which we have met with the same arrangement of these organs is in the *Glandula mollis* Stimpson." This statement of the uniqueness of this type of gonads written more than a quarter of a century ago, almost holds good to-day in spite of the great number of species of *Styela* and closely related genera that have since been described. The only other species that I have noticed in the literature (though I have not examined quite all of it with reference to the point) having a similar type of gonads is *S. floccata* Sluiter, 1904. Here there are also five gonadial cylinders on each side placed transversely. A particularly interesting fact is that the four species mentioned as having this unusual style of gonads are very distinct in various other particulars, and all belong to quite distinct geographical regions.

Another point deserving special attention is the double system of folds in the stomach, as shown in figure 24 *st.* It will be seen that in addition to the oblique folds on the outer surface and anterior half of the organ, there is a set of longitudinal folds on the posterior half. A fact concerning these last that is not very clearly brought out by the figure is that these longitudinal folds are a modification in direction of the set of oblique folds of the inner surface of the stomach. Finally, the rigidity of the animal, the regularity of its shape, and the heavy uniform coat of black sand, make the species very distinct, even in so large an assemblage of species as that constituting the genus *Styela.*

The collection contains about 90 specimens from *Albatross* station 3270, lat. 55° 26′ 30″ N.; long. 162° 52′ W., depth 16 fathoms (type locality); and about 15 specimens from station 3288, lat. 56° 26′ 30″ N.; long. 160° W., depth 15 fathoms. The first of these hauls was made on June 26, 1890, and the second on July 17 of the same year. Both stations are in Bering Sea, the first in the extreme eastern part in Bristol Bay, the second a little west of this.

The haul from station 3288 also contained *Agnesia beringia.*

Type.—Cat. No. 5687, U.S.N.M.

STYELA LOVENI (Sars).

Ascidia loveni Sars, 1851, p. 157, No. 101.
Cynthia loveni Sars, 1858, p. 65.
Styela loveni Kiaer, 1893, No. 9, p. 48.—Hartmeyer, 1903, p. 209, text figs. 6–11; pl. 5, figs. 4–6; pl. 11, figs. 6–9.
Styela aggregata Traustedt, 1880, p. 410; 1883, p. 480, pl. 36, fig. 17; pl. 37, figs. 9–12.—Hartmeyer, 1899, p. 479, text fig. E.; pl. 22, fig. 8; pl. 23, fig. 5.
Tethyum loveni Hartmeyer, 1909*a*, p. 1359.
Goniocarpa loveni Huntsman, 1911, p. 131.

(See Hartmeyer, 1903, for fuller synonymy and discussion of same, and variation of this species.)

There are only two specimens in the collection which I assign to this species. That they are specifically the same as the animals which Kiaer and Hartmeyer have treated as *S. loveni* there can be little doubt. On the question of whether the original *Ascidia loveni* was really of the same group I do not pretend to have a first hand opinion, since I have not seen Sars's description. I do not hesitate, however, to follow Kiaer and Hartmeyer, since both are not only acquainted with Sars's work, but also have had opportunity to study specimens from the locality from which his animals came. Both specimens are of the flat form and are attached to stones. One of them is so much flattened as to be hardly more than a thick disk closely and broadly adherent to the stone. Neither possesses any of the furriness which, according to Hartmeyer, is found on some individuals of the species, and is so characteristic of the closely related species *S. hemicæspitosa*. In his first paper dealing with *loveni*, Hartmeyer (1899) says, "jederseits zwei wurstartige Ovarien." However, this is probably a slip of the pen, since both the text and figures of his later work (1903) show but one ovary on each side.

Albatross 3331, lat. 54° 01′ 40″ N.; long. 166° 48′ 50″ W. Bering Sea, 350 fathoms, bottom m., August 21, 1890, 1 specimen.

Dall No. 1161, anchorage Big Koniuji Island, Shumagin group, Alaska, 6 to 20 fathoms, sand, rocks, 1 specimen.

STYELA GIBBSII Stimpson.

Styela gibbsii Stimpson, 1864.—Herdman, 1898, p. 261, pl. 13, figs. 1–4.—Ritter, 1900, p. 604, pl. 18, figs. 13, 14; 1907, p. 23.—Huntsman, 1911, p. 131.
Tethyum gibbsii Hartmeyer, 1909*a*, p. 1359.

There are 4 specimens of this common Puget Sound species from the Sound collected on rocks, between tides by O. B. Johnson in July, 1889. These need no remark, as they are perfectly typical.

In addition there are a dozen specimens from off Oregon which, while agreeing closely with Puget Sound animals in external characters, differ from them slightly in a few particulars of internal structure.

The following tabulation presents the results of the examination of two of the Oregon specimens:

No. 1. Endostyle $\begin{cases} 4\text{–}\mathit{17}\text{–}9\text{–}\mathit{12}\text{–}6\text{–}\mathit{12}\text{–}6\text{–}\mathit{6}\text{–}4 \text{ L.} \\ 10\text{–}\mathit{11}\text{–}8\text{–}\mathit{8}\text{–}4\text{–}\mathit{10}\text{–}7\text{–}\mathit{7}\text{–}4 \text{ R.} \end{cases}$

No. 2. Endostyle $\begin{cases} 5\text{–}\mathit{20}\text{–}8\text{–}\mathit{12}\text{–}4\text{–}\mathit{19}\text{–}5\text{–}\mathit{12}\text{–}3 \text{ L.} \\ 6\text{–}\mathit{23}\text{–}6\text{–}\mathit{14}\text{–}5\text{–}\mathit{16}\text{–}6\text{–}\mathit{11}\text{–}4 \text{ R.} \end{cases}$

Comparison of these figures with those given by Herdman (1898) for this species shows that in number of tentacles and vessels on the folds the present specimens are somewhat higher than those examined by Herdman from Puget Sound. I can not, however, regard the deviation from the type as anything more than a variation that would be without specific significance were a sufficiently long series of individuals to be examined.

Albatross 3088, off Oregon coast, lat. 44° 28′ N.; long. 125° 25′ 30″ W., 46 fathoms, c. p., September 3, 1889, 12 specimens.

On rocks, between tides, Puget Sound, July, 1889, O. B. Johnson, collector; 4 specimens.

Albatross 2945, "off southern California," lat. 34° N.; long. 119° 29′ 30″ W., 30 fathoms, p., February 6, 1889, 1 specimen.

STYELA YAKUTATENSIS Ritter.

Styela yakutatensis RITTER, 1901, p. 241, pl. 27, figs. 22, 23.
Tethyum yakutatense HARTMEYER, 1909*a*, p. 1360.
Katatropa yakutatensis HUNTSMAN, 1911, p. 129.

This species was founded for a lot of pedunculated Styelas collected in Yakutat Bay, Alaska, the peduncle of which was, however, much shorter, relatively, that that of *S. montereyensis* (Dall) and *S. greeleyi* Ritter. Since the peduncle of the single specimen now before me is even shorter proportionally than the average for the Yakutat animals, and since it comes from the same geographical region, I do not hesitate to assign it to the same specific group. The body of the individual is 13 mm. long, and the peduncle is 7 mm., while the average for the Yakutat specimens measured was 18.11 mm. for the body and 10.1 for the peduncle. Furthermore, the transition from body to peduncle is even more abrupt here than is usual in the Yakutat specimens.

Albatross 2877, lat. 48° 33′ N.; long. 124° 53′, 59 fathoms, bk. s. and m. (Strait of Juan de Fuca), September 25, 1888.

STYELA ?, sp.

A single individual of some member of the Styelidæ found adhering to the stalk of *Boltenia ovifera* taken at *Albatross* 3303 deserves mention even though its exact identification is impossible. A curious thing about the specimen is that in spite of the fact that it is in a good state of preservation, and seems to be fully grown, not a trace of gonads can be found. This being the case, even its generic identity must remain in some doubt. After *Styela* the genus to which it is most likely to belong is *Pandocia* (or *Polycarpa*), and this is one of the points that makes it interesting, for with this possible exception this genus is not represented in the collection, nor is it known to occur in Alaskan waters. I have suspected that the seeming absence of gonads may be due to the fact that these may be present in the form of immature polycarps and so might be mistaken for endocarps, which are present in considerable numbers. However, such is not the case so far as I can make out; and since in all recognizable particulars it is a *Styela*, and since this genus is well represented in the region, I assign it provisionally to this group. In nearly all respects it agrees with *S. loveni*, but the internal longitudinal vessels are rather different, there being fewer on the folds and more between them. The formula is:

$$\begin{matrix} \text{L. } 5\text{–}\mathit{3}\text{–}3\text{–}\mathit{9}\text{–}4\text{–}\mathit{5}\text{–}2\text{–}\mathit{12}\text{–}2 \\ \text{R. } 3\text{–}\mathit{5}\text{–}2\text{–}\mathit{11}\text{–}2\text{–}\mathit{6}\text{–}3\text{–}\mathit{11}\text{–}5 \end{matrix} \text{ D. L.}$$

STYELOPSIS GROSSULARIA (Beneden).

Ascidia grossularia P. J. van Beneden, 1846, p. 61, pl. 4, figs. 7–11.
Styela grossularia Traustedt, 1880, p. 416.
Styelopsis grossularia Traustedt, 1882, p. 115.—Hartmeyer, 1903, p. 252, pl. 5, figs. 12, 13.
Dendrodoa grossularia Michaelsen, 1904, p. 19.
Styelopsis grossularia Bjerkan, 1908, p. 9.—Redikorzew, 1907, pp. 12, 28.
Dendrodoa grossularia Hartmeyer, 1909, p. 1361.—Van Name, 1912, p. 588, pl. 64, figs. 118, 119.

I can find no differences between the animals before me and the descriptions of *Styelopsis grossularia* that would warrant the separation of them from this species. The single cluster of specimens is a very compact mass containing 35 or 40 individuals ranging in size from scarcely 1 mm. to 12 mm. in greatest diameter. Many of the small individuals are seated upon larger ones, the largest of all being completely covered over by the coating of smaller ones.

None of the individuals seem to approach the columnar form which characterizes many though by no means all individuals of the species.

The departure of these specimens from the *grossularia* type that may possibly be important is the almost complete absence of siphons. Although the orifices with their four lobes can readily be recognized, there are no projecting siphons. Possibly, however, the absence of siphons is more seeming than real. The specimen, from St. Paul Island, is almost certainly a pick-up on the beach and had been subject to considerable buffeting before it was preserved. This, together with the usual contraction which nearly all ascidian orifices undergo at death, may account for the absence of the structures.

It is quite impossible to separate the individuals from one another, the fusion being almost as complete as though the mass were one of compound ascidians.

The internal organs are typically grossularian, considering the range of variation of the species that has been pointed out, particularly by Herdman, 1882, Lacaze-Duthiers and Delage, 1893, and Hartmeyer, 1903. The only possible exceptions to this statement are these: The fold projecting into the intestine, or typhlosole, is very prominent in the specimens at hand, it extending nearly the whole length of the gut and in places nearly dividing the lumen into two; the pyloric pouch of the stomach is relatively short in the individuals examined and seems not to reach across the intestinal loop to the opposite limb of the intestine, as it is figured as doing in *grossularia;* and finally, the lobes of the testes in my specimens are more numerous and voluminous relative to the ovary than seems to be the case with individuals of *grossularia* heretofore described.

Taken all in all, I conclude that, while it is possible it is not probable that the study of more ample material will find it necessary to set off the Bering Sea members of the *Styelopsis* group from *grossularia*, and that, consequently, the already very wide range of this species must be extended by several thousand miles.

A single mass of specimens from St. Paul Island, Bering Sea, taken in July, 1897.

DENDRODOA TUBERCULATA Ritter.

Plate 34, fig. 27

Dendrodoa tuberculata Ritter, 1899, p. 512, figs. 1–5.—Hartmeyer, 1903, p. 243, pl.5, fig. 9; 1909*a*, p. 1362.

The genus *Dendrodoa* is one of those groups of organisms which the more it is studied (up to some limit not yet ascertained in this case) the more dubious become the boundary lines of the subgroups into which it may be divided. When I described the two species, *tuberculata* and *subpedunculata*, in 1899 it seemed that the delimitations, not only between these two species but also between these and any of the previously known species, was satisfactorily definite. Since then, however, the studies of Hartmeyer and now my own have brought out strikingly the great variability of the animals, and so demonstrated that the subgroup boundaries can be made out only by the most searching examination of a great quantity of carefully collected well-preserved material representing the whole geographic range of the genus.

TABLE 12.

No. of specimen.	Collector.	Locality.	Depth in fathoms.	Size in mm.	Color.	Test.	Tentacles.	Folds of sac.	Longitudinal vessels on sac.	Total vessels.	Average vessels in folds.	Average vessels between folds.	Stigmatas in mesh.	Gonad lobes.	Stomach folds.	Anal lobes.
1	*Albatross* ...	Otter Island, Bering Sea.	?	70 by 35...	Dark red......	Strongly tuberculate.	27	4	....	....	9–12	4–5	20	6	29	None.
2	*Albatross* 3216.	South of Alaska Peninsula.	61	40 by 20...	Whitish and reddish brown.	Wrinkled tuberculate.	24	4	L. 2-13-4-7-3-11-2-7-2 R. 2-11-3-9-5-10-2-7-2 end.	51 49	95 9. +	2.6 2.4	6 to 8	5	35	30 rolled back.
3	*Albatross* 3505.	Bering Sea....	44	32 by 25...	Reddish brown.	Strongly tuberculate.	18	4	L. 0-14-1-4-?- 8-1-4-1 R. 1-13-1-7-1-11-1-7-1 end.	33 43	7.5 9.5	.6+ 1	20 max.	11	24	?
4	Dall, 1038...	....	...	30 by 15...	Dark brown...	Finely wrinkled tuberculate.	29	4	L.......... R..........	....	....	....	20 to 25	5	26	?
5	*Albatross* 2845.	Unalaska to Cook Inlet.	42	30 by 15...	Reddish brown.	Tuberculate...	14	4	....	....	7–16	3–4	5 to 7	5 or more.	26	28 fine.
6	*Albatross* 2849.	....do........	69	30 by 10...	Yellowish brown.	Wrinkled tuberculate.	19 all short.	4	....	....	..4–16	.....	6 or 7	5	22	Finely lobed.
7	*Albatross* 3262.	Bering Sea....	43	25 by 17...	Light brown..	Rough........	22	4	L. 2-13-3-9-4-12-4-7-3..... R. 2-14-4-10-4-10-4-8-3.....	57 59	10.25 10.5	3.2 3.4	9	7–8	30 about.	28
8	*Albatross* 3216.	South of Alaska Peninsula.	61	21 by 21...	Whitish reddish.	Wrinkled tuberculate.	30	4	L. 1-16-2-10-3-11-4-7-2.... R. 2-13-4-11-4-11-4-8-2....	56 59	11 11—	2.4 3.2	9 or 10 or 12	5	About 30	?
9	*Albatross* 3504.	Bering Sea....	34	17 by 19...	Gray..........	Finely wrinkled.	25	4	L. 1-12-0-4-2-7-1-5-? R. 1-13-0-5-1-8-1-6-1 end.	32 36	7 8	.8 .8	26	5	Present.	One large no small.
10	Turner......	Unalaska.....	...	15 by 20...	Light to dark brown.	....do........	30	4	R. 1-16-2-9-3-7-3-3-2 end ..	46	8.75	2.2	12 or more in some.	5	24	Slightly notched.
11	Dall	Unalaska......	...	10 by 20...	Dark.........	.....do........	44	4	L. ?-13-1-6-1-8-1-5-1...... R. ?-13-1-7-1-9-1-6-1......	32 35	8+ 9—	1 1	15	6	23	None.
12	*Albatross* ...	Nikolski, Bering Island....	...	12 by —...	Milk white, gray.	....do........	31	4	L. 0-10-1-3-1-7-1-4-1 R. 0-10-1-6-1-8-1-3-1 end.	28 31	6 6.75	.8 .8	16	4	23	Slightly notched.
13	.....do......	.....do........	...	10 by 10...	.....do........	.....do........	25?	4	L. 1-13-1-6-1-10-1-7-2 R. 1-13-1-8-1-10-1-8-1 end	42 44	9 9.75	1.2 1	16 in some.	5	23	3 indistinct.
14	*Albatross* 3536.	Bering Sea....	40	10 by 10...	....	.....do........	42	4	L. 0-14-1-4-1-8-1-5-1 R. ?-12-1-4-1-7-0-6-0 end.	35 30	7.75 7.25	.8 .4	25 in some.	6	Present.	Slightly notched.
15	*Albatross* 3213.	South of Alaska Peninsula.	41	5 by 3.....	Light yellowish.	Tuberculate...	16	4	10 to 16 on folds.........	....	......	......	7 to 9	5	24	Many.
16	....	Kamchatka...	?	8..........	Light gray....	Minutely wrinkled.	Lost..	4	L. ?-10-?-3-0-7-0-5-0 R. ?-11-?-6-1-9-0-7-0 end.	25 34	6.25 8.25	? ?	6 to 10 or more.	4	Numerous.	?

Hartmeyer, 1903, points out that most of the characters which I relied upon chiefly for distinguishing *tuberculata* from *subpedunculata*, and both these from *aggregata*, occur within the range of individual variation of *aggregata*. He, however, finally decides not to include my species in the older species, but considerately leaves to me to determine what weight in this direction should be attached to his observation. After deliberating long on the considerable evidence now before me I am strongly of the opinion that, in spite of the undoubted great range of variation of both *aggregata* and the Bering Sea animals, the latter are sufficiently distinct from the former to deserve being considered as specifically distinct. The points which I rely upon most in support of this conclusion are the greater degree of tuberculation and of hardness of the test of *tuberculata*, the darker coloration of *tuberculata*, and particularly the character of the stomach. This member is, judging from my examination of specimens of *aggregata* sent me by Hartmeyer, as well as by the figures and descriptions given by various authors, relatively longer, more sharply set off from the intestine, and, perhaps most important of all, more distinctly folded as viewed from the external surface than in any of the north Pacific animals. It is probable, furthermore, that the longer rectal portion of the intestine in *aggregata* and the absence there of anal lobes are constant differential marks. Although, as indicated by the tabulation, there is great variety in the lobulation of the anal rim in the specimens I have examined, it is doubtful if they are wholly absent in any case, as they seem to be regularly in *aggregata*.

The almost complete invisibility of the folds of the stomach wall as seen from the external surface, though very prominent inside in all the Bering Sea specimens examined, is in striking contrast with their distinctness in *aggregata*. The difference is due seemingly to the greater thickness and closer adherence of the peritoneal layer in the *tuberculata* group. I am quite confident, therefore, that future, more thoroughgoing study will increase rather than diminish the distinctness of a group that will fall under the designation *tuberculata*.

Concerning the specimens from *Albatross* 3262 I have more doubt than about any others which I am calling *tuberculata*. Externally they strongly resemble many individuals of *Styela rustica*. The tentacles, furthermore, in some of these are remarkably short and stubby. Also the great number, seven, of branches of the ovary in some individuals arouses suspicion when considered in connection with the other differences noted that we may be dealing here with representatives of a different group. In view, however, of the great variation to which the whole genus is obviously subject I have not deemed it best to describe these as a distinct species. For example, the large number of ovarian branches (fig. 27) would have been considered, according to the earlier practices in dealing with the Dendrodoas, in itself a sufficient characterization of a distinct species. But, as the table shows, two specimens of the most typical *tuberculata* (Nos. 2 and 4) possess the one 11, the other 9 lobes; and in general the variation in number of these is so great as to deprive them of much classificatory value, at least so far as this species is concerned. The remarkable reduction in the size of the branchial tentacles would at first sight also seem sufficient to exclude these specimens from *tuberculata*. But this again is one of those seemingly freakish variations that occur in some organisms. The smallest individual of the lot, being 14 by 12 mm., had three tentacles situated about at the quadrants, of good length and thickness, and no other, unless one or two at the very earliest stage of development, for I have no doubt that in this group new tentacles are added until a comparatively late period in the lifetime of the individual animals.

Mention ought also to be made of the fact that the stomach in some, though not in all the specimens in this lot, resembles that of *D. aggregata* more than it does that of the typical *tuberculata*. This in conjunction with the lighter color and diminished tuberculation of the test, has somewhat inclined me at times to assign these specimens to *aggregata*. But the lobing of the anal rim and on the whole the character of the digestive canal and the branchial sac have prevailed in favor of considering them as representing a strongly marked race or form of *tuberculata*.

? *Albatross* station 3505 (3 specimens), lat. 57° 09′ N.; long. 168° 17′ W., 44 fathoms, fne. gy. s., July 28, 1893.

Albatross station 2845 (1 specimen), lat. 54° 05′ N.; long. 164° 09′ W., 42 fathoms, crs. bk. s., July 29, 1888.

Albatross station 2849 (5 specimens), lat. 55° 16′ N.; long. 160° 28′ W., 69 fathoms, gn. m., August 2, 1888.

Albatross station 3213 (8 specimens), lat. 54° 10′ N.; long. 162° 57′ 30″ W., 41 fathoms, bk. s.

Albatross, 2 specimens, Otter Island, Bering Sea.

Albatross station 3262 (a dozen specimens), lat. 54° 49′ 30″ N.; long. 165° 02′ W., 43 fathoms, bk. s. r., June 24, 1890.

Albatross station 3504 (2 specimens), lat 56° 57′ N.; long. 169° 27′ W., 34 fathoms, fne. gy. s. bk. sp., July 28, 1893.

Albatross station 3216 (5 specimens), lat. 54° 20′ 30″ N.; long. 163° 37′ W., 61 fathoms, bk. s. m., May 21, 1890.

Albatross station 3536, lat. 57° 05′ N.; long. 170° 35′ W., 40 fathoms, gn. m. fne. s., August 8, 1893.

Other than *Albatross* stations: About 75 specimens, mostly small and in a compact mass, Unalaska, Alaska, washed up by the waves, Turner collection; about 20 specimens, Constantine Bay, Amchitka Island, 8 fathoms, Dall collection 1038; 2 specimens, Unalaska, Dall collection; 3 clusters, Kyska Harbor, beach, Dall collection 1873; 2 specimens, no data.

DENDRODOA SUBPEDUNCULATA Ritter.

Dendrodoa subpedunculata RITTER, 1899, p. 514, figs. 6-8.—HARTMEYER, 1903, p. 245; 1909*a*, p. 1362.

While my later study of the Dendrodoas has strengthened my conviction of the distinctness of *D. tuberculata* as a species, such has hardly been the result with regard to *subpedunculata*. Indeed, I am dubious about retaining the species since I am now obliged to rely on superficial characters entirely for separating it from *tuberculata*. The characters drawn from the branchial sac, to which I formerly gave much weight for distinguishing the two species, now seem very doubtful, as do all others drawn from the internal organization. However, the external differences are on the whole so numerous and pronounced that I have resolved to continue to recognize *subpedunculata*. In most of the specimens now under examination the test is light gray, in some cases almost milk-white, and is soft as compared with that of *tuberculata*. Furthermore, some of the individuals incline to pedunculation quite pronouncedly.

The specimens are so closely fused together, little and big ones, that it is next to impossible to separate them or even to distinguish one from another in some places. For the purpose of more convenient comparison I have included this species with *tuberculata* in the tabulation, Table 12.

There are two dozen or more specimens secured by the *Albatross* at Nikolski Island, Bering Sea, on June 3, 1892, and 1 specimen from Kamchatka and 5 specimens from Commander Islands, collected by Leonhard Stejneger in 1882–83; also 1 specimen from Adakh Island, *Albatross*, July 2, 1893.

DENDRODOA ADOLPHI (Kupffer).

Cynthia adolphi KUPFFER, 1874, p. 245.
Dendrodoa adolphi HARTMEYER, 1903, p. 244, pl. 10, fig. 10; 1909*a*, p. 1361.

I have not seen the original description of this species. However, Hartmeyer's account of it is sufficient to leave little or no room for doubt that the specimens at hand belong here. But since Hartmeyer's study of the species was restricted to a few poorly preserved individuals, making it impossible for him to settle a number of points, it will be best to give a full diagnosis of the species here.

Superficial characters.—Body nearly spherical and quite regular when not distorted by crowding or by pressure from some other source. Orifices not far apart, both opposite the side of attachment; siphons distinct but not long. Color nearly uniform light brown. Surface of the test presenting a great number of shallow, close wrinkles, on the whole somewhat more distinct in the posterior hemisphere, and extending around the body; but irregular radial ones present also. Some of the individuals (older ones?) with surface much more roughened, almost warty. Test thin and tough, of quite uniform thickness throughout. All individuals firmly attached, some to the peduncles of *Boltenia* and some to others of their own kind; the area of attachment not large. Largest individuals about 1 cm. in diameter; mostly smaller.

Respiratory system.—Orifices indistinctly four-lobed. Branchial tentacles about 55, simple, all in one circle, long, and of approximately uniform length. Atrial tentacles present, slender, about 20 in number. Hypophysis mouth an almost but not quite closed circle, the opening turned toward the left. Branchial sac with four folds on each side; formula of internal longitudinal vessels in two specimens as follows:

$$\text{No. 1. Endostyle}\begin{cases}0\text{–}\mathit{14}\text{–}0\text{–}\mathit{4}\text{–}1\text{–}\mathit{10}\text{–}0\text{–}\mathit{5}\text{–}0 \text{ L.}\\ 0\text{–}\mathit{15}\text{–}0\text{–}\mathit{5}\text{–}1\text{–}\mathit{11}\text{–}0\text{–}\mathit{7}\text{–}0 \text{ R.}\end{cases}$$

$$\text{No. 2. Endostyle}\begin{cases}0\text{–}\mathit{8}\text{–}0\text{–}\mathit{4}\text{–}1\text{–}\mathit{8}\text{–}1\text{–}\mathit{6}\text{–}0 \text{ L.}\\ 0\text{–}\mathit{11}\text{–}0\text{–}\mathit{5}\text{–}1\text{–}\mathit{9}\text{–}1\text{–}\mathit{7}\text{–}0 \text{ R.}\end{cases}$$

Stigmata straight, about 8 to 20 in a mesh. Dorsal lamina a plain broad membrane.

Alimentary system.—On left side of body; esophagus rather long, slender and curved; stomach well-defined, regular, spindle-shaped, wall closely and regularly longitudinally folded, the folds 25–27 in number; from the stomach the intestine forms an almost circular bend, coming back to form a contact with the esophageal end of the stomach, at which point it makes an abrupt turn forward and downward to terminate in a narrow hook; anus with a smooth lip.

Reproductive system.—On right side, a trident-shaped body, the three prongs springing from a common basal piece in general running clearly parallel with one another. *Endocarps* present and well developed.

Hartmeyer expresses the view that *D. adolphi* may not be a good species; that it may have to be united with *D. aggregata.*

The examination of these specimens puts beyond question the validity of the species. From *aggregata* it is distinguished by the greater number of tentacles and fewer number of gonadeal prongs. In four specimens the tentacle numbers were 51, 54, 55, and 58. This is more than double the number ascribed to *aggregata,* a difference too great to be due to fluctuating variation.

The three-parted state of the gonads appears constant, though in one of the individuals examined one of the prongs was connected with the others by a small isthmus only, suggesting that in other cases it might be wholly separated, and so leave the gonad in the two-branched state which Hartmeyer (1899) has found to prevail in some specimens of *D. kükenthali.* As a matter of fact, the last-mentioned species would seem to be very close to *D. adolphi,* though *kükenthali* has a larger number, 64, of tentacles.

From *D. tuberculata*, *adolphi* is sharply distinguished in external features first of all by the distinct, though short wart-like siphons of the latter species. Furthermore, the body of *adolphi* is more nearly spherical, more regular, the test is more delicate, and the color is lighter. Internally the small number of gonad branches in *adolphi* sharply distinguishes the species from *tuberculata*.

D. adolphi was originally described from Shannon Island, near the coast of Greenland, and has not been reported from any other locality until now. There are about 150 specimens, large and small, in the one lot, taken at Cape Etolin, Nunivak, Alaska, by Dr. W. H. Dall in 8 fathoms.

PELONAIA CORRUGATA Goodsir and Forbes.

Pelonaia corrugata Goodsir and Forbes, 1841, p. 30, pl. 1, fig. 1.—Alder and Hancock, 1907, vol. 2, p. 145, pl. 46, figs. 15, 16; pl. 47; pl. 48, fig. 18; text figs. 81 and 82.—Hartmeyer, 1903, p. 203, pl. 5, fig. 14.—Huntsman, 1911, p. 132.—Van Name, 1912, p. 545, text fig. 29; pl. 58, figs. 84, 85.

The early synonymy of this species is given in detail by Alder and Hancock, by Hartmeyer, and by Van Name.

After working with specimens so equivocal in their characters as compared with their kindred as to drive one almost to madness to know what disposition to make of them, it is a great pleasure to come upon a lot of individuals like those now in hand, that are no more dubious as to their place in the scheme of classification than are recently minted pieces of money.

It is certainly worthy of note that in spite of the wide distribution of *Pelonaia corrugata*, it being circumpolar in the Arctic Ocean, and extending as far south in the Atlantic as the British Islands in Europe, and the New England coast in North America; and in spite of its having been so long known and collected and studied by so many zoologists, it has never seemingly been assigned to any other genus.

Albatross 3253, 36 fathoms, mud and sand bottom, lat. 57° 05′ 50″ N.; long. 164° 27′ 15″ W. (southeastern Bering Sea); June 14, 1890. A single specimen.

U. S. R. S. *Corwin* 1880, 2 specimens (no further data).

CHELYOSOMA COLUMBIANUM Huntsman.

Chelyosoma columbianum Huntsman, 1911, p. 124.

The character upon which Huntsman has chiefly relied to distinguish this species from *C. productum* is the presence of short stout muscle fibers connecting the central plates. Such fibers are present in the specimens now under examination; and since they seem, from the extensive study of the musculature by Bancroft, 1898, to be wholly wanting in the typical Chelyosomas of Puget Sound and the regions southward, *columbianum* stands by this character alone as a well-marked species. But the specimens at hand bear out Huntsman's statement that *columbianum* also differs somewhat from *productum* in size, shape, and position of orifices. On the whole, too, the number of tentacles seems to be greater in *productum*.

About two dozen specimens, *Albatross* 2876, lat. 48° 33′ N.; long. 124° 53′, off Cape Flattery, Washington, 59 fathoms, bk. s. September 25, 1888.

One specimen, *Albatross* 2866, lat. 48° 09′ N.; long. 125° 03′ W., 171 fathoms, gy.s., September 20, 1888.

These two stations are near the entrance to the Strait of Juan de Fuca.

Half dozen specimens, no label, probably from same locality.

CHELYOSOMA PRODUCTUM Stimpson

Chelyosoma producta STIMPSON, 1864, p. 161.
Chelyosoma productum v. DRASCHE, 1884, p. 381, pl. 7, figs. 5–9.—BANCROFT, 1898, pp. 309–332, pl. 18, figs. 1–14.—HARTMEYER, 1909*a*, p. 1392.—HUNTSMAN, 1911, p. 124.

A single specimen from Puget Sound of this common species is in the collection, with no data beyond the fact that it is from the Sound.

CORELLA WILLMERIANA Herdman.

Corella willmeriana HERDMAN, 1898, p. 252, pl. 11, figs. 1–4.—RITTER, 1900, p. 604, pl. 18, fig. 15.—HUNTSMAN, 1911, p. 122.
Corella rugosa HUNTSMAN, 1911, p. 122.

There is certainly considerable difficulty in the way of placing the specimens now under consideration in this species.

There are five specimens from Puget Sound and eight from Loring, Alaska. Taken altogether these differ in such ways from the typical *willmeriana* that, were they to be regarded as specifically distinct from *willmeriana*, there would be as much reason for making two as one new species, and the line of cleavage between them would not separate the Puget Sound from the Loring specimens.

The distinctive characters are as follows:

Puget Sound specimens: Larger, length as great as 4 cm.; test rather thick and semicartilaginous; orifices both 6-lobed (as seen on siphon dissected from test), clear though not conspicuous; tentacles 47; dorsal languets large, well apart; internal longitudinal vessels about 20 on each side of sac; the coils of branchial stigmata very regular; stomach rather large and globose, with 20 to 25 longitudinal folds.

First Loring collection, one specimen, size 3 by 1.5 cm., very transparent, test thin, but somewhat stiff; orifices rather uncertain, 6 or 7 for each; tentacles 47; dorsal languets large and far apart; internal longitudinal vessels of branchial sac 23 on right and 24 on left; stigmatic spirals very irregular in form and distribution; stomach globular, wall with 20 to 25 folds; anus distinctly lobed.

Second Loring collection, 5 specimens, size 2 by 1½ cm., test very thin, soft, and transparent; lobes of orifices uncertain, 6, 5, or 4, tentacles 43 to 45; dorsal languets large and well separated; internal longitudinal vessels of sac about 22, and small papillæ on them corresponding to the short vessels by which the longitudinal vessels are connected with the branchial membrane; stigmatic spirals very regular, as in Puget Sound specimens; stomach globular, wall with 20 to 25 folds.

All the Loring specimens were attached to *Halocynthia villosa*, and were elongate and narrowed toward the point of attachment.

Puget Sound specimens from O. B. Johnson, July, 1889.

Loring specimens, *Albatross*, Alaska salmon investigations, April 29, 1903.

NOTE.—Huntsman's *C. rugosa*, the description of which has come to hand since the above was written, does not do away with the variational difficulties noted by me. The roughened test and more anterior position of the atrial aperture which, according to Huntsman, distinguish *rugosa* from *willmeriana* are certainly inapplicable as distinctive marks for the specimens before me, both being so far as I can see strictly individually and quite independently variable. My largest Puget Sound individual is entirely smooth-surfaced, while a second, nearly as large, is unmistakably roughened and papillate. A smaller individual is smooth or nearly so on one side and conspicuously rough on the other. The Loring specimens present much the same range of variation in this particular.

The other point on which Huntsman relies for separating the species is the number of longitudinal vessels, *willmeriana* being assigned 24 right and 22 left; while *rugosa* is given 20 to 22 on each side. This difference is quite too small to be held as specifically significant unless based on averages of a large number of determinations. As a matter of fact I find 20 on each side in a large Puget Sound individual, and 22 to 23 in the Loring animals.

CORELLA JAPONICA Herdman.

Plate 35, figs. 28–30.

Corella japonica HERDMAN, 1882, p. 190, pl. 16, figs. 1–9.—SLUITER, 1900, p. 20 —HARTMEYER, 1906, p. 25; 1909*a*, p. 1393.

Discussing this species in his final report on the *Challenger* ascidians Herdman recognized its close resemblance to *C. eumyota* Traustedt (1882), but pointed out a number of characteristics which seemed sufficient to distinguish it from Traustedt's species. The results of my comparison of the specimens at hand with the descriptions of *japonica* and *eumyota* led me at first to the conclusion that my specimens, even though from the Japanese coast, agreed more closely with *eumyota* than with *japonica*. This was surprising because *eumyota* comes from the eastern coast of South America. But since the beginning of my studies I have had the opportunity, thanks to Hartmeyer, to examine specimens from Yokohama and identified by him as *japonica*, and do not now hesitate to regard my specimens and his as being of the same species; nor do I seriously question that both sets of specimens are the same as the ones examined by Herdman; that is, that all are *japonica*. It appears from a late paper by Hartmeyer (1906) that he found no difficulty in the way of identifying his Japanese animals as Herdman's species. There are, however, a few points, two particularly, in which my observations do not quite agree with Herdman's description, and since it was just at these points that I formerly thought my specimens agreed more closely with *eumyota* than with *japonica* I have thought it desirable to present a few drawings and write explicitly of these matters. The first to be noticed is the mantle musculature. Herdman called special attention to the peculiarity of this but his statement and figure need modifying somewhat to make them apply to the specimens which I have examined. He says, "In *Corella japonica* the musculature is very strongly developed along the dorsal part of the left side, while in *Corella eumyota* there is no such disproportionate development"; and his figure 2, plate 26, illustrates this statement. In all the specimens examined by me as well as in those from Yokohama and identified by Hartmeyer as *japonica* and those belonging to the U. S. National Museum collections, while the muscle fibers are undoubtedly well developed along the dorsal ridge, they are not particularly more so there than all the way around an elliptical area corresponding to nearly the entire left side; in fact in the specimen from which figures 28 and 29 were drawn the fibers are distinctly more numerous and quite as strong all along the ventral edge of the area as along the dorsal. In the specimens which I have examined the area of relatively heavy mantle muscle fibers might be characterized as a distinct patch of elliptical shape corresponding in general to the left side of the animal; and one of the striking things about this patch is the sharpness of its boundary as determined by the abrupt ending of the muscle fibers along nearly the whole circumference. Figures 29 and 28, the first of the left, the second of the right side of the same individual, illustrate this. The abrupt termination of the more or less radially disposed fibers on the dorsal and posterior edges is clearly seen in the figures, while the ends along the ventral and anterior edges can only be inferred from the fact that the fibers are present on the left side and do not pass over on to the right side at all. In some specimens the circumference of the muscle "patch" is as distinctly visible all the way around on the left as it is in figure 29 along the posterior end.

The second point of divergence of my results from Herdman's description concerns the tentacles. These are said by Herdman to be all of one size in *japonica;* and in his schematic classification of the species of *Corella,* given on page 190, he makes this the final criterion for differentiating *japonica* from *eumyota,* the last being characterized by tentacles of two sizes. In all the specimens examined by me the tentacles are at least of two sizes, and although the difference, particularly in length, is not great, it is undoubted. And an interesting fact about the difference is that, particularly in some individuals, the larger tentacles are bent in toward the center of the circlet — that is, toward the branchial orifice—distinctly more than are the smaller ones. This difference in disposition of the tentacles of different sizes is especially observable in one of the individuals from Yokohama sent me by Hartmeyer.

Figure 30, showing the arrangement of the stigmata in one of my specimens, corresponds so well with Herdman's figure 5, plate 26, as to leave no doubt about the agreement in this regard; but the end-to-end and reversed dispositions of the openings as here seen is worthy of particular notice since this seems to afford one of the best distinctions between *C. japonica* and *C. æquabilis* Sluiter (Sluiter, 1904, p. 17), end-to-end arrangements of the stigmata in the same infundibulum not occurring in Sluiter's species.

Concerning *C. japonica* and *C. eumyota,* as our information now stands the best differentiating marks are the larger number of branchial tentacles and the greater irregularity and the different modes of coiling (Herdman, 1910) of the stigmata in *eumyota.* The difference in the mantle musculature and the size of the tentacles, especially appealed to by Herdman, do not seem to hold, at least on the ground on which he placed those differences. The statement by Traustedt, 1882, page 285, that *C. japonica* is distingished from *C. eumyota* by papillæ on the internal longitudinal vessels of the former and their absence in the latter is due to error on Traustedt's part, papillæ not being present in *japonica.*

Five specimens from *Albatross* 3656, Hakodate Bay, Japan, 11.5 fathoms, *gn. m. s.*

Three specimens from station 3659, Hakodate Bay, Japan, 15.5 fathoms, *fne. gy. s.*

Both lots taken September 19, 1896.

CORELLA, species.

At *Albatross* 3088, off the coast of Oregon, a single specimen of a Corella was taken which, though sufficient to enable one to determine with certainty the genus to which it belongs, is not sufficient to warrant a decision as to the species.

CORELLOPSIS PEDUNCULATA Hartmeyer.

Corellopsis pedunculata HARTMEYER, 1903, p. 273, pl. 5, fig. 15; pl. 12, figs. 1–5.

Although the single specimen at hand differs in some respects from Hartmeyer's description of this species, the differences are entirely too small to justify the making of another species on the strength of the evidence at hand. The lobing of the orifices in Hartmeyer's specimen was vague, so the author was unable to state positively the number of lobes present, six being given with a question for both orifices. The exact state of things is dubious here also, but this much is clear: There are on the atrial orifice four prominent bands on the inside of the orifice, each terminating in several irregular lobes or crenulations.

Seventeen branchial tentacles are present, of two or three sizes, the largest being long and strong.

The rudiments of internal longitudinal vessels of the branchial sac are much longer in our specimen than are those figured by Hartmeyer. It appears, too, that the secondary series of internal vessels shown by Hartmeyer as running radially and diagonally from the center of each stigmatic spiral are less regular in the present specimen.

One specimen, *Albatross* 2842, lat. 54° 15′ N.; long. 166° 03′ W., 72 fathoms, pebble bottom, July 23, 1888.

CORYNASCIDIA HERDMANI, new species.

Plate 35, figs. 31–36.

Superficial characters.—Strongly pedunculate, the peduncle being one and one-third, or more, longer than the elongate body and, in its thinnest part, from one-fifth to one-sixth the thickness of the body in its dorso-ventral diameter, thinnest in its middle portion and from here expanding gradually but distinctly to its foot; peduncle composed mostly of testicular material of the same general character as that of the body, hence transparent like the body. Body elongate (fig. 31) about twice as long as thick, quite regular, cylindrical, though soft, tapering abruptly to the peduncle, colorless and quite transparent, the relatively small, compact, dark visceral mass occupying the postero-dorsal angle showing distinctly through the external coverings. Siphons, both at the anterior end, separated by the diameter of the body, atrial long, tube-like, curved backward; branchial very short. Orifices rather large, the branchial with a wide thin lip or flange subtending nearly its dorsal semicircumference; atrial with five broad, thin, scallop-like lobes, with two or three irregular smaller ones in the intervals between some of the larger ones. Test rather thin except on peduncle, soft and gelatinous, very transparent. Mantle very thin, musculature sparse, but the longitudinal fibers assembled into distinct though small and widely separated strands none of these extending farther back than the visceral mass; circular fibers very few and restricted almost entirely to the siphons. Length of body 4 cm., of peduncle 6 cm., diameter of peduncle in smallest part about 5 mm.

Respiratory system.—Tentacles disposed in a wide single circle (fig. 34 *b. t.*), the individuals simple, long and slender all nearly equally long and thick, about 100. Hypophysis very small, elliptical, long and narrow (fig. 36). Branchial sac capacious but the elements all very slender and fragile; internal longitudinal vessels present, numerous, very small (fig. 33, *i. l. v.*), borne at the summits of long thin posts, this making this system of vessels rather widely and loosely connected with the branchial membrane proper; transverse vessels (*t. v.*) in the form of narrow irregular strands between the serie of stigmata; stigmata very large and long, the prevailing direction of the long axes being lengthwise of the sac, but in places at right angles to this and in some areas the quadrangular arrangement of the vascular net-work characteristic of the genus may be seen (figs. 33 and 35.) Dorsal languets (fig. 35, *d. lu.*) long and slender in keeping with the other elements of the respiratory apparatus.

Alimentary system.—A rather small compact mass, situated far back and dorsalwards but apparently more to the left (specimen out of shape to such an extent as to make certainty impossible); intestinal loop narrow elongate, but simple (fig. 32); stomach, *st.*, not very distinct from intestine, with 25 or 30 indistinct folds on inner surface; anal rim smooth.

Reproductive system.—Ovary, one only, elliptical, rather compact, situated in the intestinal loop; testes diffuse, scattered over the ovary, in part, and extending on to the gastric limb of the intestinal loop (fig. 32, *ov.* and *tes.*)

Although clearly belonging to the genus *Corynascidia,* the species now described and named for Professor Herdman, the founder of the genus, is sharply distinguished from the other two species heretofore described.

The most unique feature about the animal is the branchial orifice. In its wide lip, or valve (fig. 31, *b. s.*), the species reminds one of *Pterygascidia mirabilis* Sluiter, 1904. Of the two previously known species of the genus, *herdmani* resembles *C. suhmi* Herdman much more closely than it does *C. sedans* Sluiter, Sluiter's species being nonpedunculate.

In general features, the siphons and orifices disregarded, *C. suhmi* and *C. herdmani* have much in common, but the character of the stigmata (fig. 33), as well as that of the orifices, sharply differentiates the species. Over large areas of the sac very little or no suggestion of the quadrate or spiral disposition of the stigmata occurs in *C. herdmani.*

I regret not being able to determine more exactly the relations and orientation of the visceral mass, especially with reference to the branchial sac; but in ascidians so soft as this and indeed in most of the deep-water species, more or less derangement of the parts in preserved specimens seems almost inevitable.

The question of the dorsal tubercle is also puzzling. On the evidence of a single specimen not in the best state of preservation I would not venture to declare it to be entirely wanting, but although the area where it should be is intact, I am unable to discover the organ.

Type-locality.—A single specimen, *Albatross* 3326, lat. 53° 40′ 25″ N.; long. 167° 41′ 40″ W. Bering Sea, 576 fathoms, muddy bottom, August 20, 1890. This location is a little north of Unalaska, where the bottom drops off quite abruptly to a considerable depth.

Type.—Cat. No. 5683, U.S.N.M.

AGNESIA BERINGIA, new species.

Plate 36, figs. 37–41.

Superficial characteristics.—Varying from elongate-laterally compressed to short-elliptical compressed, and from a soft and clean surface layer to one moderately firm with much adhering and embedded sand. Test proper colorless and semitransparent, but often entirely hidden by the coating of coarse, black sand. A long slender peduncle frequently, though not always, present. Siphons hardly visible. Largest individuals 3.7 cm. in greatest diameter, most of the lots considerably smaller. Mantle thin and delicate, its musculature being but little developed, and confined to the anterior end of the body; a series of distinctly separated nearly parallel muscle fibers surrounding each orifice, and a set of distant, short fibers radiating from each orifice.

Respiratory system.—Orifices rather near together, at the anterior end in the elongate individuals, the branchial being considerably in advance of the atrial usually (not so in the one shown in fig. 37). Lobing of the orifices obscure, six to eight lobes being indistinctly recognizable. Tentacles simple, of several sizes, disposed in several rather uncertain circles. Total number 50 or more, the smallest mere buds. The circlet of largest tentacles nearest, and very near the peripharyngeal band, the smallest nearest the branchial orifice (fig. 39 *b. t.*). All of the tentacles thick, particularly at base, in proportion to their length separated from one another by liberal spaces. Hypophysis a somewhat urn-shaped elliptical mass with the broader, open end forward; a peculiar prominent flap of epithelial membrane on the right side of the organ (fig. 39 *hy.*). The ganglion long and slender, in close contact with the hypophysis at its anterior end. Dorsal languets consisting of what seem to be a series of enlarged papillæ of the inner surface of the branchial sac, there being one for each transverse vessel; the series a little to the right side of the median line. The median line itself marked by a narrow strip of the branchial membrane in which there are no stigmata (fig. 40 *d. l.*). Branchial membrane with neither longitudinal folds nor vessels, but with prominent transverse vessels or folds, the edges of which are armed with numerous long, strong processes each conical in shape with its free apex usually curved or hooked, about 10 or 12 of these vessels in each sac. Stigmata long and closely and definitely coiled, there being in general two rows of spirals in the interval between each two transverse vessels; about three or four turns in each spiral; usually four somewhat irregular vessels radiating quadrant-wise from the center of each spiral (figs. 40, 41).

Alimentary system.—On the left side, the stomach and first half of the intestine forming a close loop reaching across the posterior end of the body; the second or rectal half of the intestine forming nearly a right angle with the first part, and running forward along the dorsal side of the body (fig. 37). Stomach but little thicker than the intestine, and not definitely set off from it; wall smooth. Anus with a somewhat toothed border (fig. 38).

Reproductive system.—In the intestinal loop, the ovary a rather regular mass situated centrally (*ov.* fig. 38), with the testes disposed in the form of a fringe around this, the whole when fully developed spreading sometimes over the outer surface, sometimes over the inner surface, and sometimes over both surfaces of the intestinal loop. Gonoduct large, running parallel with the intestine and in close contact with it, *ov. d.*, in some individuals to the outside, in some to the inside of the rectum.

The genus *Agnesia* was founded by Michaelsen (1898) for an ascidian rather closely related to *Corella*, coming from Tierra del Fuego. A much fuller description of the animal was published by the same author in 1900. Up to the present time no other species of the genus has come to light, and it is an interesting circumstance that the second one should come from a latitude in the northern hemisphere almost the counterpart of that in the southern from which the first species comes (southern Tierra del Fuego, the home of *A. glaciata*, the original species, is in about 53° south, while the specimens of *A. beringia* come from 54° to 57° north in Bering Sea).

On the whole, too, it seems that the two are very much alike. It is true that *A. glaciata* is described as being without a peduncle, and since the present species is pedunculated this difference of itself would seem to separate the two generically almost, to say nothing about specifically. However, Michaelsen had only two specimens, one a small one, and the other, seemingly full-grown, was badly injured. This fact, along with the fact that many of the specimens at hand seem to be devoid of the peduncle makes me suspect that, were a large number of individuals of the South American species to be examined, some of them would be found to possess the peduncle. Assuming this interpretation of the seeming difference between the two species as regards the peduncle to be correct, the other differences between them seem to be slight. Michaelsen says that there may be as many as nine coils in each stigmatic spiral in *A. glaciata.* Four, or at most five, appear to be the maximum number in *beringia.* But of more importance, perhaps, the spirals in *glaciata* are made up of a considerable number of stigmata placed end to end, while in *beringia* one or two stigmata constitute the entire spiral.

A wide range of individual variation occurs in our species. From some of the stations the specimens are all of the maximum size, or nearly so, given in the diagnosis, and the large ones are nearly devoid of sand on the test, and have rather thicker, more opaque tests. Some of the other gatherings, on the other hand, are very heavily coated with sand, and the test is very thin and transparent.

Again, the position and course of the genital ducts differ considerably, they being plainly visible in surface views in some specimens, and quite hidden by the rectum in others. I fail, however, to find any constancy and correlation of these variations that would warrant the institution of more than one species.

The collection contains several hundred specimens, all from the southeastern Bering Sea mingled with *Styela sabulifera* in some jars:

Albatross 3261, lat. 54° 42′ 15″ N.; long. 164° 49′ 15″ W., 27 fathoms, bk. g. p., June 24, 1890.

Albatross 3284, lat. 56° 16′ 30″ N.; long. 160° 53′ W., 25 fathoms, fne. g., June 29, 1890.

Albatross 3287, lat. 56° 33′ N.; long. 160° 14′ W., 30 fathoms, crs. bk. s., July 17, 1890.

Albatross 3288, lat. 56° 26′ 30″ N.; long. 160° W., 15 fathoms, bk. g., July 17, 1890.

Albatross 3525, lat. 57° 21′ N.; long. 170° 05′ W., 29 fathoms, bk. s. sh., August 4, 1893.

Albatross 3543, lat. 56° 41′ N.; long. 169° 39′ W., 43 fathoms, bk. s. sh., August 18, 1893, type locality.

Albatross 3560, lat. 56° 40′ N.; long. 169° 20′ W., 43 fathoms, fne, gy. s. bk. sp., September 3, 1893.

Albatross 3496, lat. 56° 32′ N.; long. 169° 45′ W., 41 fathoms, gy. s. st. gn. m., July 17, 1893.

Type.—Cat. No. 5689, U.S.N.M.

An interesting memorandum occurs on the reverse side of the label for station 3287 to the effect that one of the specimens was attached to the back of a shrimp of the genus *Crago.*

NOTE.—Since the above was written Huntsman (1911) has described a species, *A. septentrionalis,* from the west coast of Canada. This, too, appears to be nonpedunculate, and in other respects somewhat more like *glaciata* than *beringia.*

PHALLUSIA VERMIFORMIS, new species.

Plate 36, fig. 42.

Superficial characters.—Long and irregularly cylindrical, the general appearance being considerably that of the tubes of some of the tubicolous worms, particularly some of the chætoptera. Length of longest specimen 140 mm., width 30 mm.; surface uneven, bearing on and embedded in it various foreign bodies as sponges, hydroids, calcareous algæ, etc. Test rather thick, opaque white, semicartilaginous. Animal apparently attached along whole right side. Branchial orifice at anterior end, atrial nearly half way back on dorsal side; lobing of orifices obscure, apparently eight for each; scarcely siphonate, though atrial orifice at the summit of a prominence. Mantle very thin and delicate on the left side, but thick and strong on the right, forming on this whole side a distinct pad or "sole."

Respiratory system.—Tentacles 100 to 150, long and slender, several sizes. Hypophysis mouth horseshoe-shaped, the left limb nearly straight, the right strongly hooked inward but not coiled. Branchial sac drawn out behind the digestive tract into a straight appendage considerably longer than the portion in front of the intestine (pl. 36, fig. 42 *b. p.*), and about one-half as broad as the anterior part. Wall of sac slightly if at all plicate; internal longitudinal vessels bearing papillæ only at the points of crossing of the transverse vessels; that is, no intermediate papillæ present. Seemingly no exception to this. From 3 to 5 stigmata between the longitudinal vessels. Transverse vessels of nearly same size. Dorsal lamina a rather broad membrane, edge smooth throughout; sides of the membrane ribbed posteriorly but not anteriorly; extending considerably behind the esophageal opening but not to the end of the posterior pouch of the sac.

Alimentary system.—A very compact mass small in proportion to the size of the branchial sac, it being hardly longer than the portion of the sac in front of it, and considerably shorter than the posterior pouch of the sac. Esophagus narrow and sharply curved; stomach globose, inner wall longitudinally furrowed, somewhat irregularly, some furrows being bifurcate. Furrows about 14 in number. Loop of the intestine following the stomach long and close. Renal organ a finely ramifying network on intestinal wall and within the intestinal loop.

Reproductive system.—Lying in the intestinal loop, sperm duct and oviduct following closely the course of the rectal bend of the intestine, the oviduct only visible to surface view for the proximal two-thirds of the length of the two, the sperm duct lying deeper and appearing only toward the end of the course (fig. 42, *ov. d.* and *s. d.*). Male and female gonads not readily distinguishable in the specimens at hand.

This species belongs to the *mentula* section of the genus, that is, the section with the branchial sac extending well behind the intestinal viscera, and seemingly surpasses all other species in the length of the posterior pouch. So far as concerns size and proportions of the animal as a whole, it appears to resemble *Ascidia elongata* Roule more than any other species. However, in internal structure it appears to differ quite sharply from that species. Although the description of *elongata* (Roule, 1884) is not full enough to enable me to make comparison complete at every point, it is sufficient to warrant the inference that *vermiformis* differs from *elongata* in the greater relative length of the postvisceral sac pouch, in the greater number of tentacles, and in the absence of intermediate papillæ on the internal longitudinal vessels; also the intestinal mass of *vermiformis* seems to be more compact and more elongate, proportionally, than that of *elongata*. These inferences are drawn from Roule's statements concerning the similarities and differences between *elongata* and *mentula*.

Type-locality.—*Albatross* 2945, lat. 34° N.; long. 119° 29′ 30″ W., off southern California, 30 fathoms, pebbly bottom, February 6, 1889; 4 specimens.

Type.—Cat. No. 5792, U.S.N.M.

Worth noting is the fact that two crustaceans were found in the branchial sac of one of the specimens. These have been kindly identified by Miss Mary J. Rathbun of the United States National Museum. One was *Pontonia californiensis*, a shrimp; the other *Cryptophrys concharum*, a crab.

PHALLUSIA UNALASKENSIS, new species.

Plate 36, figs. 43–45.

Superficial characters.—Very soft and mobile to handling; elongate, subcylindric, length 6 cm. major, transverse diameter 2.5 cm. Firmly attached at posterior end to sand-encased worm tubes. Branchial orifice anterior, atrial distant from branchial about the diameter of the branchial siphon; both orifices 6-lobed, the lobes not conspicuous on surface, but clearly marked by radiating ridges on inner surface of test; orifices situated on summits of firm rounded mound-like siphons, the branchial larger (pl. 36, fig. 43). Test thin and transparent throughout except in the siphonal mounds. Mantle very thin and almost as transparent as glass excepting for the small scattered muscle fibers contained in it on the right side of the body and around the orifices; the abrupt thickening at the branchial orifice in the above-mentioned mound-like siphon forming a conspicuous object on the animal removed from the test.

Respiratory system.—Branchial tentacles about 24, of several sizes, but all very small in proportion to the size of the animal, situated on a low ridge running concentric with the peribranchial band, from which it is removed about one third the distance between the peripharyngeal band and the branchial orifice; the individual tentacles separated from one another by a liberal interval (fig. 44, *b. t.*). Peripharyngeal band low and narrow, scarcely larger than the ridge carrying the tentacles; quite remote from the branchial orifice, making a large peribranchial area which is smooth and uninterrupted except by the tentacular circlet. Hypophysis mouth (*hy.*) rather small, horseshoe-shaped, somewhat broader than long, the horns approaching each other and directed toward the branchial orifice. Sub-neural gland and ganglion forming a single elongate mass removed from the hypophysis somewhat more than the length of the gland. Dorsal lamina (*d. l.*, fig. 44) low and broad anteriorly, changing gradually to a high, thin membrane near the esophageal opening, then tapering down rapidly to its termination some distance behind that point; sides ribbed throughout; edge remotely toothed posteriorly but not anteriorly. Branchial sac voluminous, not extending farther back than the visceral mass; the membrane corrugated, the corrugations very irregular, being neither continuous lengthwise nor of equal depth. Longitudinal vessels about 25 on each side, these large and membrane-like. Transverse vessels also somewhat higher than thick, but much smaller than longitudinal, rather narrow and of nearly the same size; distance between each two longitudinal vessels nearly equaling three spaces between transverse vessels. Papillæ restricted mostly to the crossings of the vessels, these being prominent and strongly curved, the concave side of the curve presenting a membrane-like expansion; intermediate papillæ few, irregularly scattered and small in comparison with the papillæ at the angles. Stigmata long and narrow, from 6 to 15 between the two longitudinal vessels (fig. 45).

Alimentary system.—Situated on left side, voluminous, occupying nearly two-thirds the length of the animal and the whole depth. Stomach situated at the extreme postero-dorsal angle of the body, somewhat longer than broad, distinctly set off from the intestine; wall with 14 or more folds showing prominently on inner surface but not at all on outer. Intestine proper forming a broad low reverse S as seen from the outer face, the proximal limb running along the ventral edge of the body from its issuance from the stomach; the distal or rectal limb along the dorsal edge and somewhat farther forward than the first loop of the intestine; anus obscurely 4-lobed. Renal vesicles and concretions thickly distributed in the wall of stomach and first part of intestine.

Reproductive system.—Testes ramified over outer surface of posterior end of stomach, and the portions of the intestine adjacent to stomach. Ovary a branched structure not visible on outer surface of the digestive viscera, but ramifying on the inner surface of the first intestinal loop. Gonoducts not recognized.

This species has considerable in common with *P. obliqua* (Alder), more seemingly than with any other. Indeed, in view of the fact that the collection contains but a single specimen—too small a number on which to base a satisfactory description of a species—I have tried to persuade myself that it might, provisionally at least, be considered as falling within the range of variation of *obliqua*, particularly as Hartmeyer has pointed out that *obliqua* is a highly variable species. However, the distinct 6 lobes of the branchial orifice, the remoteness of the ganglion and gland from the hypophysis, and the wide separation of the internal longitudinal vessels as compared with the transverse vessels, not to speak of several less important points, leaves no room for doubt about the distinctness of this Alaskan species from *obliqua*, its nearest of kin.

Type-locality.—A single specimen, *Albatross* 3315, lat. 54° 02′ 40″ N.; long. 166° 42′ W. (north of Unalaska Island), 277 fathoms, gn.m.s., August 15, 1890.

Type.—Cat. No. 5685, U.S.N.M.

PHALLUSIA ADHÆRENS (Ritter).

Ascidia adhærens Ritter, 1901, p. 227, pl. 27, figs. 1–5.
Ascidiella prunum Hartmeyer, 1909*a*, p. 1401.

Since Hartmeyer has considered *P. adhærens* a synonym for *P. prunum* (Müller), I have not only examined the specimens of the collection now in hand with special care, but have reexamined the original specimens from which *adhærens* was described and am forced to conclude that the Alaskan animals possess features of considerable and constant difference from *P. prunum*. Hartmeyer gives the tentacle number for *prunum* as 40–50, this being the average of a large number of specimens. The average number in *adhærens* is undoubtedly much fewer. I agree with Hartmeyer that the number of tentacles in this group is very difficult to determine with much accuracy, is subject to much individual variation, and hence is not of great value as a species character. Nevertheless, within wide limits and when averages are taken, it is of some value. The average for six specimens now before me I find to be 31, the maximum being 50 and the minimum 19.

But the two most decisive features are in the branchial sac and the alimentary tract. Van Name has recently published a drawing of the branchial membrane of *prunum*.[1] If this be compared with figure 5, plate 27 (Ritter, 1901), showing the sac of *adhærens*, it will be seen that, while the areas bounded by the intersecting longitudinal and transverse vessels in *prunum* are nearly square, in *adhærens* at least two areas between the transverse vessels are required to make one between the longitudinal vessels.

[1] Van Name, 1912, pl. 66, fig. 129.

Turning to the digestive tract, the descriptions and figures given by both Hartmeyer and Van Name make it apparent that the stomach of *prunum* graduates more insensibly into the intestine than it does in *adhærens*. By this difference what corresponds to the duodenal section of the intestine is broad at its proximal end and tapers distally in *prunum*, whereas in *adhærens* it is of nearly uniform diameter throughout. Again, the folding of the stomach wall is usually distinctly seen on the outer surface of the organ in *adhærens*, while this seems not to be so in *prunum*. There are probably other, smaller differences between the two species, but these are sufficient to indicate their distinctness.

It appears to me extremely doubtful if *P. columbiana* Huntsman is distinct from *adhærens*.

Three specimens, Kodiak Island, 16–25 fathoms, gravel bottom, W. H. Dall.

One specimen, New Harbor, Unga Island, 1872, W. H. Dall.

One specimen, Sitka, L. A. Beardslee, collector.

One specimen, *Albatross* 3558, lat. 56° 58′ N.; long. 170° 09′ W., Bering Sea, 25 fathoms, s. dk. sp. rky., September 3, 1893.

Ten specimens, Bering Sea, summer, 1900, Dr. H. Horn.

One specimen, *Albatross*, Loring, Alaska, April 29, 1903, Alaska salmon investigations.

The specimens collected by Doctor Horn are worthy of special mention in that, though from Bering Sea (it is unfortunate that the locality is not more definite), they are, in outward features at least, somewhat more typical than most of the other specimens coming from nearer the original localities, namely, the Shumagin Islands and Yakutat Bay.

CIONA INTESTINALIS (Linnæus).

The single specimen of *Ciona* in the collection is so badly out of shape and contracted that determination of all its characteristics is impossible. So far as can be ascertained, however, nothing would warrant separating it specifically from the old and widely distributed species. And in view of the fact that the species is definitely known to occur in the whole arctic region and also on the coast of Japan, western Canada, and California, it would be expected to be found in Alaskan waters.

The tentacles, branchial sac, and dorsal languets agree entirely with those of typical *intestinalis*. Uncertainty exists only as to the relation of the digestive tract and gonads, and here the uncertainty is entirely from the impossibility of determining the exact state of things, not from any recognized disagreement.

One specimen, *Albatross*, Alaska salmon investigations, Loring, Alaska, April 29, 1903.

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EXPLANATION OF PLATES.

PLATE 33.

Fig. 1. View of left side of *Eugyrioides dalli*, test removed. The first bend of the intestine is more open in the specimen figured than is typical. × 1. *b. s.*, branchial siphon; *int.*, intestine; *ov.*, ovary; *st.*, stomach; *tes.*, testis.
2. A tentacle of *E. dalli*. *b. t.*, branchial tentacle.
3. Branchial sac of *E. dalli*, inner surface. *i. l. v.*, internal longitudinal vessels; *s.*, stigmata; *t. v.*, transverse vessel.
4. *Halocynthia washingtonia*, surface view, left side. × 1. *a. s.*, atrial siphon.
5. Orifices of *H. washingtonia*. *a. s.*, atrial siphon; *b. s.*, branchial siphon.
6. Esophagus, stomach, and "liver" of *H. washingtonia*, showing wide separation of the parts of the liver. *es.*, esophagus; *l.*, liver; *l'.*, secondary liver; *st.*, stomach.
7. *Halocynthia haustor foliacea*. × *a. s.*, atrial siphon; *b. s.*, branchial siphon.
8. *Hartmeyeria triangularis*. × 2/3. *b. s.*, branchial siphon; *ped.*, peduncle.
9. *H. triangularis*, test removed to show particularly the arrangement of the muscle bands of the mantle. *b. s.*, branchial siphon; *int.*, intestine; *m. f.*, muscle fibers; *ov.*, ovary.
10. *H. triangularis*, left side, mantle with adhering alimentary and reproductive systems dissected and turned back to expose the inner face of these and the outer face of the branchial sac. *b. s.*, branchial siphon; *b. sc.*, branchial sac; *gon.*, gonad; *int.*, intestine; *l.*, liver.
11. *H. triangularis*. *b. t.* branchial tentacles; *ef*, *ef'* the unique epithelial folds; *gn.* ganglion; *hy*, the hypophysis; *pg–pg'*, peripharyngeal groove.
12. Atrial tentacles and periatrial fold, *H. triangularis*. *a. t.*, atrial tentacle; *p. a. f.*, periatrial fold.
13. Branchial membrane of *H. triangularis*. *b. f.*, branchial fold; *d. l.*, dorsal lamina; *t. v.*, transverse vessel.

PLATE 34.

Fig. 14. *Culeolus sluiteri*, surface view. × 1. *b. s.*, branchial siphon; *ped.*, peduncle.
15. Tentacle of *C. sluiteri*. *b. t.*, branchial tentacle.
16, 17. Gonads, right and left side respectively, of *C. sluiteri*. *int.*, intestine, *ov.*, ovary; *tes.*, testis.
18. *Styela macrenteron*. A small short individual, with a prominent intersiphonal horn. × 2/3. *b. s.*, branchial siphon.
19. *S. macrenteron*. An elongate individual, mantle of left side thrown back to expose the reproductive and alimentary systems. × 2/3. *ov.*, ovary; *r.*, rectum; *tes.*, testis.
20. The intestinal tract of *S. macrenteron* at its extreme of length and coiling. × 1. *an.*, anus; *int.*, intestine; *r.*, rectum; *st.*, stomach.
21, 22. *Styela hemicæspitosa*, "high" and "low" forms, respectively. × 1½.
23. Alimentary and reproductive systems of *S. hemicæspitosa* and their relation to each other. *ov.*, ovary; *tes.*, testis.

Fig. 24. *Styela sabulifera*, left side view, mantle removed to expose the parts. × 3. *gon.*, gonad; *st.*, stomach.

25. Hypophysis, branchial tentacles, dorsal lamina, and branchial sac of *Styela sabulifera*. *b. t.*, branchial tentacle; *d. l.*, dorsal lamina; *hy.*, hypophysis; *i. l. v.*, internal longitudinal vessels.
26. Gonad of right side of *S. sabulifera*. *ov.*, ovary; *tes.*, testis.
27. *Dendrodoa tuberculata*. A gonad of the most highly branched form. *gon.*, gonad.

PLATE 35.

Fig. 28, 29. *Corella japonica*, right and left side views respectively; test removed × 2. *b. s.*, branchial siphon; *int.*, intestine; *m. f.*, muscle fibers; *ov.*, ovary; *s. d.*, sperm duct; *st.*, stomach; *tes.*, testis.

30. Branchial sac of *C. japonica*. *d. l.*, dorsal lamina; *i. l. v.*, internal longitudinal vessels; *s.*, stigmata.
31. *Corynascidia herdmani*, right side, surface view. × 1. *b. s.*, branchial siphon; *ped.*, peduncle.
32. Alimentary and reproductive systems of *C. herdmani*. *ov.*, ovary; *ov. d.*, oviduct; *s. d.*, sperm duct; *st.*, stomach; *tes.*, testis.
33. Branchial membrane of *C. herdmani*. *i. l. v.*, internal longitudinal vessels; *s.*, stigmata; *t. v.*, transverse vessel.
34. Branchial tentacles and mantle muscle bands of *C. herdmani*. *b. t.*, branchial tentacle; *m. f.*, muscle fibers.
35. Dorsal languets with adjacent parts of *C. herdmani*. *ant.*, anterior; *d. lu.*, dorsal languets; *i. l. v.*, internal longitudinal vessels; *rt.*, right; *s.*, stigmata; *t. v.*, transverse vessel.
36. Hypophysis and small piece of peripharyngeal groove of *C. herdmani*. *hy.*, hypophysis; *p. g.*, peripharyngeal groove.

PLATE 36.

Fig. 37. *Agnesia beringia*, left side, test removed. × 1. *b. s.*, branchial siphon; *int.*, intestine; *gon.*, gonad.

38. Alimentary and reproductive systems of *A. beringia*. *int.*, intestine; *ov.*, ovary; *ov. d.*, oviduct; *st.*, stomach; *tes.*, testis.
39. Branchial tentacles, peripharyngeal groove, and hypophysis of *A. beringia*. *b. s.*, branchial siphon; *b. t.*, branchial tentacle; *hy.*, hypophysis.
40. Whole dorsal area of branchial sac of *A. beringia* showing the processes on the transverse vessels with larger ones near the mid-dorsal line which seem to take the place of dorsal languets. *d. l.*, dorsal lamina; *p.*, papilla; *p. g.*, peripharyngeal groove; *t. v.*, transverse vessel.
41. The branchial membrane of *A. beringia* in detail. *p.*, papilla; *t. v.*, transverse vessel.
42. *Phallusia vermiformis*, test removed, left side. × ½. *a. s.*, a trial siphon; *b. p.*, branchial pouch; *b. s.*, branchial siphon; *ov. d.*, oviduct; *s. d.*, sperm duct; *st.*, stomach.
43. *Phallusia unalaskensis*, anterior end, test removed. *b. s.*, branchial siphon.
44. Hypophysis, branchial tentacles, and dorsal lamina of *P. unalaskensis*. *b. t.*, branchial tentacle; *d. l.*, dorsal lamina; *g.*, hypophyseal gland; *gn.*, ganglion; *hy.*, hypophysis; *p. g.*, peripharyngeal groove.
45. Branchial membrane of *P. unalaskensis*. *i. l. v.*, internal longitudinal vessels; *p.*, papilla; *t. v.*, transverse vessel.